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SPRINKLING SEWAGE FILTER FLY

PSYCHODA ALTERNATA SAY

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INTRODUCTION

This small light-colored moth-like fly has proven itself a serious nuisance wherever sprinkling filters have been utilized for the purification of fæcal sewage. When the sprinkling filters are located at great distances from human habitation the matter seems to have proven a nuisance only; but when located within reach of human habitation three-fourths of a mile or less, these flies penetrate the houses, get into the foods and are accused by the persons concerned as being the carriers of infections from which they suffer. There seems to be no clearcut evidence to show that they are responsible for the carriage of infections, but in the opinion of the part of the public concerned they are firmly identified as carriers, and suits at law have been and are always likely to be filed against the municipality or company running such a filter plant.

The Joint Sewer Committee of the City of Plainfield and the Boroughs of North Plainfield and Dunellen, feeling that everything possible should be done to render the sewage disposal plant under its charge a pleasant neighbor for the people living in the vicinity, called the senior author into consultation for the purpose of finding out a way to eliminate this nuisance. A survey of the literature showed that the only method holding out any hope of controlling the pest was one embodied by Metcalf and Eddie in their advice to use charges of hypochlorite of lime.

After considerable reflection, the senior author decided that a study of the insect and its habits would have to be made and a test of the various insecticides instituted.

Habits and Life-History

The work began when the sprinkling filter still had a capping of ice. It was found that each piece of stone had upon it a more or less complete amorphous coating, which on examination proved to be exceedingly complex, being composed of a groundwork or matrix of gelatinous material in which and on which were found immense numbers of bacteria, algæ, protozoa (single celled animals), worms (unsegmented and segmented) and arthropods, principally crustacea and insects. The sprinkling sewage filter fly was found in the maggot and pupa stages resting in this film with the breathing tube or tubes projecting through the film and securing atmospheric air.

As soon as possible the junior author undertook the task of determining the life-history and habits. This study continued through the spring into the summer. It was found that the principal species concerned was *Psychoda alternata* Say, but that during the latter part of April *Psychoda cinerea* Banks appeared. It was found that with the opening of warm weather, the flies emerged from the over-wintering pupæ and larvæ in such numbers that for a period it was almost impossible to breathe while working at the filter without getting some of them in the nose and mouth. After the over-wintering film had broken down and sluffed off and the warm weather film had begun to form, the flies rapidly disappeared until they became so scarce as no longer to form a nuisance. Records of the preceding summer (1917) show that with the advancement of the season the summer film becomes heavier and the flies more abundant until in the month of August, when they reach a density greater even than that of the fore part of the warm season.

It seems that the abundance of flies is correlated with the thickness of the film. A thick heavy film is normally accompanied by a tremendous breeding of the sprinkling sewage filter fly.

A study of the food habits of the maggots showed that the feeding takes place in the film and that the food apparently consists of portions of the film. This habit of feeding, of course, serves to explain the increase in fly breeding which accompanies an increase in the thickness of the film.

The eggs are laid upon the surface of the stone in irregular masses of from 30 to 100. The egg is about .36 mm. long and .17 mm. wide, oval in shape, white in color and resembles under a microscope nothing so much as a very small rice grain. With the exception of the yolk,

the egg is almost transparent. From 32 to 48 hours were required for hatching at a temperature of 70° F.

The larvæ or maggots are very much like mosquito wrigglers, and seem to pass their existence in much the same way. Soon after hatching they make their way into the film where they thrust their breathing tubes through the film itself. The number of larvæ on a sprinkling sewage filter bed is almost unbelievably large. A single square inch of stone has been found to accommodate as many as sixty specimens. The larvæ are present throughout the filter from top to bottom, but they are most abundant in the zone which begins three inches below the surface and ends twelve inches below the surface. The length of the larval stage ranges from nine to fifteen days under a temperature of 70° F. The largest active larva taken at any time in this study was 9.2 mm. long.

Transformation to the pupa takes place in the location where the larvæ fed and developed. The pupa, of course, does no feeding and is able to move only by jerking its abdomen. The pupa is about 6 mm. long, exclusive of the breathing tubes, and requires from 20 to 48 hours to complete development at 70° F.

Control

The habits of the adult fly are such as to preclude the control of the species through the destruction of the mature form. Nothing short of covering the filter with screening which has been treated with a substance similar to tanglefoot could be depended upon to destroy the adult. The shutting off of the air supply, which would result from covering the filters in this way was thought by the engineer in charge to be undesirable from the standpoint of the effective operation of the filter. Furthermore, the cost of such an installation would be large and the length of time the netting would remain effective would be limited.

The problem of control seemed therefore to narrow down to a question of destroying the fly in its immature stages. In view of the fact that the immature stages of the fly, with the exception of the egg, are passed in the film, which is the active agent in the purification of the sewage, it seemed necessary to secure an agent, which would be selective in its action in destroying the immature stages of the fly and not seriously injuring the other components of the film. A considerable number of chemicals was tried in all cases with a view of determining the minimum dosage for the fly and its effect on the life and activity of the other elements of the film. The tables which follow will serve to show the results.

TABLE OF INSECTICIDES I

	Borax	Hypochlorite of Lime	Stone Lime	Copper Sulphate	Iron Sulphate	Pyrethrum
1/2 in. coating	Larvæ dead Film dead	Larvæ dead Film dead	Larvæ dead Film dead	Larvæ dead Film dead	Larvæ dead Film dead	Larvæ dead Film dead
1/4 in. coating	Larvæ dead	Larvæ dead	Larvæ dead	Larvæ dead	Larvæ dead	Larvæ dead
1/8 in. coating	Larvæ dead Film dead	Larvæ dead Film dead	Larvæ dead	Larvæ dead	Larvæ dead	Larvæ dead Film dead
1/16 in. coating	Larvæ dead Film dead	Larvæ dead Film dead	Larvæ dead	Larvæ dead	Larvæ dead	Larvæ alive Film alive
1/32 in. coating		Larvæ dead Film dead	Larvæ dead Film dead	Larvæ dead Film dead	Larvæ dead Film dead	
1/64 in. coating		Larvæ dead Film dead	Larvæ dead Film dead	Larvæ dead Film dead	Larvæ dead Film dead	
1/128 in. coating		Larvæ dead Film dead	Larvæ alive Film alive	Larvæ dead Film dead	Larvæ alive Film alive	
1/256 in. coating		Larvæ dead Film dead		Larvæ dead Film dead		
1/512 in. coating		Larvæ dead Film dead		Larvæ alive Film alive		
1/1024 in. coating		Larvæ dead Film alive		Larvæ alive Film alive		

TABLE OF INSECTICIDES II

	Carbon Bisulphide	Black Leaf 40 Diluted 1-50	Black Leaf 40 Diluted 1-500	Saturated Solution of Hellebore
1 oz. to sq. foot	Larvæ dead Film dead	Larvæ dead Film alive	Larvæ alive Film alive	Larvæ dead Film dead
1/2 oz. to sq. foot	Larvæ dead Film dead	Larvæ dead Film alive	Larvæ alive Film alive	Large Larvæ dead Small Larvæ alive Film active
1/4 oz. to sq. foot	Larvæ dead Film injured but still alive	Larvæ dead Film alive	Larvæ alive Film alive	

In general the tables show that the minimum dosage for the fly is destructive to the film. Three materials, 40 per cent nicotine, carbon bisulphide and hypochlorite of lime gave some promise but the first two were eliminated by reason of their cost. Hypochlorite of lime having been indicated by these tests as a possible agent, and having been advocated by Messrs. Metcalf and Eddy on page 760, Volume III of the American Sewage Practice, the writer desired to give it a test on the bed.

Twelve pounds of hypochlorite of lime were applied at the Plainfield plant through the dosing tanks on one day, and the second day thereafter the dose was repeated. About 60 per cent of the larvæ disappeared. It seemed as if the first day's dosage killed or removed a part of the film and that the third day's dosage killed a large part of the larvæ. The incomplete kill resulting from this first treatment led to

a trial of increased strength. Similar tests were made with 15, 30 and 50 pounds per acre. The kill being still incomplete, the 50 pounds per acre treatment was repeated three days in succession and gave a kill of about 85 per cent of the maggots. Many of the maggots appeared in the final tanks alive and fully 15 per cent remained in the filter bed unharmed. The film was considerably injured by the heavier treatments, particularly the last one.

Thus it is seen that the tests of chemical substances brought forward nothing of a satisfactory nature for the control of the sprinkling sewage filter fly.

Flooding

The senior author early in the study brought into the laboratory some of the filter stones and, desiring to keep the material on them alive until the following day, covered them with tap water. When he undertook to resume examination of the film on the following day, he found that all of the maggots of the sewage filter fly were dead. This accidental observation, when correlated with the fact that the breathing tubes of the maggots and the pupæ projected through the film in such a way as to enable the creatures to obtain atmospheric air, led promptly to the suspicion that the species could be destroyed by drowning.

Examination of the film for the purpose of determining the effect of the various chemicals upon it indicated that the other animal forms at least were such as to be resistant to such a process, and the bacteriological studies made by various sewage disposal students indicated that the bacteria should be able to resist flooding for a considerable period of time. It was therefore determined to test submergence as a possible method of destroying the sewage filter fly.

Accordingly, a series of experiments were undertaken by the junior author to test out this method of destruction. In these experiments the filter stones with their covering of film were taken directly from the filter bed and placed in 6-inch burnt-clay non-glazed flower pots, the drainage hole of which was stopped up. An average of about one quart of stone was placed in each pot, and the pots set into the bed so that their tops were practically flush with the surface. As the spray played, the pots became filled with water and the stone contained in them completely submerged. The length of time was the only variant. After the treatment was completed, the stones were examined for signs of life in the larvæ and pupæ. The condition of the film was determined by making a smear on the glass slide and examining it under the microscope. The active forms of protozoa were used as an index to the life of the film. Putrefication was determined by odor only. The following table will set forth the detail of the results:

FLOODING EXPERIMENT CARRIED OUT IN FLOWER POTS

Length of Time Flooded	Condition of Larvæ and Pupæ	Condition of Film
16 hours	Alive	Alive
18 hours	Alive	Alive
22 hours	95% dead	Alive
24 hours	Dead	Alive
32 hours	Dead	Alive
36 hours	Dead	Slight putrefication
48 hours	Dead	Putrefaction

This set of experiments was repeated three times with exactly the same results. It thus seemed that submergence for twenty-four hours destroyed 100 per cent of the larvæ and pupæ and apparently did not injure the film.

Realizing that the results in the flowerpots might differ from results of the same treatment on the filter bed, we asked the Joint Sewer Committee to make the necessary preparations to submerge one quarter of the filter bed involving somewhat less than half an acre. Although the problem of blocking off the drainage pipes from this section was a difficult one it was undertaken and carried out. The entire supply of effluent was turned into one dosing tank and run into this quarter of the filter. In three hours and thirty minutes after starting, this quarter of the bed was submerged. The submergence was completed at 1.30 p. m. and the water was maintained on the bed continuously from that time until 1.30 the following day, when the sewage was turned off this quarter entirely into the other parts of the bed. In about two hours after the sewage was turned off this quarter, some of the stops were knocked out of the drains and samples of the effluent caught as it came from the treated section of the bed. Thousands of larvæ and pupæ, particularly larvæ, were swept out and careful examinations of samples showed that 100 per cent were dead. For an hour after this time the senior and junior authors watched the effluent as it came from the filter into the final Imhoff tank. Constantly during this period the water swept by well filled with these dead larvæ and a smaller number of dead pupæ. In no case were any found to be alive. This submergence was completed on Saturday afternoon. The filter was allowed to stand without water over Sunday. The following Monday the stoppings were all removed and the sewage turned back on this quarter of the bed as usual. Tests of the effluent of the filter for a week afterward by the manager of the plant, Mr. John R. Downes, indicated that the activity of the film had been in nowise impaired.

It thus seems that the sprinkling sewage filter fly, *Psychoda alternata*, and its less important relative, *Psychoda cinerea*, may be destroyed by

the simple process of submerging the sprinkling sewage filter for twenty-four hours with the ordinary sewage as delivered to the sprinkling filters without in any way impairing the efficiency of the film upon which the activity and efficiency of the sprinkling sewage filter depends.

THE USE OF PALLIATIVES FOR MOSQUITO BITES

By H. E. Ewing, *Ames, Iowa*

In our literature on mosquito control we find many references to the use of different agents for the alleviation of the itching pain that follows the bites of the mosquito. Most of these recommendations have been based upon "hearsay" reports of acquaintances who had tried them, or have been culled from a voluminous correspondence in which different individuals had related their experience with different remedies which had proved helpful. Having tried some of these palliatives with little effect, the writer determined to make an experimental investigation of the remedial qualities of the different chemicals that had been suggested.

Theory of Action of Palliatives

In most cases apparently there has been no theory as to the action of the palliatives used or valid reason for applying the same. Each individual apparently tried what accidentally suggested itself to his mind or what happened to be on hand. At one time it was believed that the inflammation and itching sensations caused by mosquitoes were due to formic acid or at least to some toxin that was neutralized by the application of an alkali. The toxin was supposed to be secreted by a specialized lobe of each group of salivary glands. This was the theory of Macloskie. The more recent work of Schaudinn and Major Williams have shown that the toxin comes not from the salivary glands but from one of the esophageal diverticula, and appears to be produced by the symbiotic action of a fungus. These more recent demonstrations have demolished the theories based on the belief that the beneficial action of an alkaline solution came through its neutralizing effect upon the acid poison of the salivary glands.

Methods

In testing the various solutions for their effect as palliatives the usual experimental methods were employed. Checks were run in each case and comparisons made with untreated bites of mosquitoes. Two or more mosquitoes, usually of the same species and always from the same environment, were allowed, or induced, to feed simultaneously

in a similar situation. These mosquitoes were always permitted to feed to repletion, after which the palliative was applied to one or more puncture spots and comparisons made with the untreated wounds for a period of approximately an hour, or until all effects of the mosquito punctures had subsided. In these comparisons special attention was paid to the amount of itching or pain felt at the treated punctures in comparison with the amount felt from the untreated ones. The amount of swelling, the size and color of the wheal, and its duration also, were observed.

Errors

Since in the application of these palliatives it was necessary to rub the injured spot somewhat, and since rubbing is known to affect the itching sensation, as well as the inflammation of the injured area, it was decided to observe the effects of a vigorous rubbing of the wound-puncture.

Abnormal wounds from injured mosquitoes or those evidently deficient in venom were excluded. Three mosquitoes were found that were apparently entirely devoid of venom. Their bites were not felt, and their presence would not have been detected except by sight, although each was allowed to feed to repletion. In such cases there was no swelling or discoloration of the skin following the puncture.

Normal Injury from a Mosquito Bite

The time required for engorgement to repletion was found to vary from one minute and twenty-five seconds to three minutes and twenty seconds. The variation in toughness of the skin appeared to be the chief factor affecting it. Aside from the sharp itching pain, that starts usually the instant the beak is inserted, no injury is noticed during the engorgement.

A few minutes after (usually about five) the first pain is felt there appears, at the point of puncture, a minute white elevated spot. This is the beginning of the characteristic wheal. It continues to grow and eventually, at the end of from twenty to forty minutes, reaches its maximum size. Soon after the wheal appears, the skin around it turns reddish. This reddish area increases in size with the development of the wheal. From thirty to forty minutes after the bite was inflicted the wheal began to diminish. As it diminished it took on a flesh color. The reddish area slowly disappears, and within one or two hours all noticeable injury is gone.

Effects of Rubbing

Rubbing of mosquito bites is almost universally practiced by the public and equally universally condemned by entomologists. The

experiments performed to ascertain its effect were very surprising. Rubbing apparently rapidly diffuses the toxin. It increases the itching at first, but if vigorously practiced, usually causes all swelling to disappear in about one-half or one-third the normal time, and with the disappearance of the swelling the itching also vanishes. Rubbing destroys the normal symptoms observed following the bite of a mos-

Date	Palliative Used	Times Applied	When Applied	Effect on Pain in Comparison with Check	Size of Wheal Compared with Check	Miscellaneous Notes
June 18	Soap	1	Immediately after bite	Same as in check	Larger	Had no effect
July 8	Soap	2	Soon after	Itching slightly less	Somewhat less	Value slight
July 8	Soap	3	Soon after	Itching less	Same size	Value slight
June 18	Bay rum (58% alc.)	2	Soon after bite	Somewhat less	About same size	Had slight effect
June 21	Alcohol (95%)	2	Soon after bite	Somewhat less	One-half as large	Decidedly helpful effect
June 22	Alcohol (30%)	2	Soon after bite	No effect	Three times the area	No beneficial effect
June 22	Alcohol (30%)	2	Soon after	Pain greater	Equal to check	No beneficial effect
June 22	Alcohol (30%)	3	Soon after	Same as in check	One-third larger	Effect injurious
June 22	Hydrogen peroxide	1	Immediately after	Same as in check	Broader but not so high	No effect
June 22	Hydrogen peroxide	2	Soon after	More pain than in check	Considerably larger	Apparently injurious
June 25	Hydrogen peroxide	3	Soon after	Same as in check	Slightly larger	Of no benefit
June 25	Hydrogen peroxide	Constantly for 15 min.	Soon after	Same as in check	Same size	No benefit
June 27	Glycerine	1	Soon after	Greater	Same size	Glycerine remained on skin until swelling left
June 27	Glycerine	2	Soon after	Greater	Larger	No value
July 5	Ammonia (Conc. aq. sol.)	1	Soon after	Itching less	Larger	
July 5	Ammonia (Conc. aq. sol.)	2	Soon after	Itching much less	Same as in check	Considerable value
July 5	Ammonia (Conc. aq. sol.)	3	Soon after	Itching much less	Same as in check	Has value as palliative
July 10	Ammonia (dilute)	1	Soon after	Same as in check	Same as in check	No effect as palliative
July 10	Ammonia (dilute)	2	Soon after	Same as in check	Larger	No effect
July 10	Indigo in water	1	Soon after	Less	Same as in check	No effect
July 10	Indigo in water	2	Soon after	More than in check	Same as in check	No value
July 10	Indigo in water	3	Soon after	Same as in check	Less	No value

quito. The wheal that develops is not so high, or as hard as when not rubbed, and it lacks much of its whitish color. Likewise, the reddish area around the wheal is not differentiated. It is merged with the diffuse wheal and is of the same color. The effects of rubbing must be kept clearly in mind in interpreting the value of palliatives.

Results

The results obtained by testing the following; soap, bay rum, 95 percent alcohol, 30 percent alcohol, hydrogen peroxide, glycerine, concentrated solution of ammonia, weak solution of ammonia, and indigo in water are given above in tabular form.

Summary

1. Hydrogen peroxide, glycerine, and indigo apparently are worthless as palliatives, and not only fail to have any alleviating effect on the injury from the mosquito bites, but apparently augment the injury. However, this apparent augmentation probably comes from the rubbing which has the effect of increasing the itching pain at first and of diffusing the wheal, although usually neither the pain or swelling lasts as long.

2. Soap, bay rum, dilute alcohol, and dilute ammonia have but slight value. Dilute ammonia is to be preferred of the four. If soap is rubbed into the skin some relief is obtained, which probably comes chiefly from the rubbing.

3. Strong alcohol and strong ammonia have the greatest value as palliatives, both giving a marked reduction in pain. There is a tendency for the former to leave a hardened lump in the place of the wheal, and the latter is rather harsh on the skin.

A NOTE ON THE LIFE CYCLE AND FERTILITY OF THE BODY LOUSE (PEDICULUS CORPORIS)

By R. H. Hutchinson

The following is a record of the rate of development and of the deposition of eggs of the body louse at body-surface temperature with unlimited opportunities for feeding. It is of special interest as giving a record of deposition higher than any heretofore published. It fully confirms the data given by Nuttall (Biology of *Pediculus humanus*, Parasitology, Vol. 10, No. 1) on the duration of the life cycle, and affords further evidence in support of his claim that the fertility of body lice has been greatly underestimated and that a true idea of

their powers of reproduction can only be obtained when they are provided with full opportunity for feeding.

The method used in this experiment was practically the same as that described by Nuttall as the "wristlet method." A small pill box was used, in the bottom of which was a large opening covered with chiffon. There was no opening provided in the top of the box. Thus, when the chiffon-covered opening of the bottom of the box was applied to the arm, there was little or no opportunity for evaporation and therefore the humidity was doubtless higher in this box than in the ones used by Nuttall in his experiments. The temperatures inside the box varied from about 30° to 35° C.

At 11.30 a. m., May 1, some infested clothing was taken from a patient admitted to Charity Hospital, New Orleans, La. From this clothing ten females were removed and placed on a small piece of clean cloth and kept in an incubator over night. Between 4.00 p. m., May 1 and 9.00 a. m., May 2, fifteen eggs were laid. Eleven of these were attached to the cloth, and were kept in a small glass vial in the incubator, at temperatures ranging from 30° to 33° C. Nine larvæ emerged between 4.00 p. m., May 8 and 9.00 a. m., May 9,—an incubation period of seven days.

These larvæ were at once placed on a small piece of dark serge cloth and put in a pill box as above described. The box was then applied to the arm and worn continuously, night and day, except for about one hour each morning when examination was made. The first molt occurred before 9.00 a. m., May 12; the second molt, before 9.00 a. m., May 14; the final molt, before 9.00 a. m., May 17. There was, therefore, a first larval stage lasting three days; a second stage lasting two days, and the third stage lasting three days, and a total period from emergence to adult of eight days. The period from deposition of the eggs to the final molt was fifteen days, and from egg to egg was sixteen days.

One male and one female were isolated from this lot at 9.30 a. m. May 17, and placed on a bit of clean cloth in another pill box. This was worn on the arm continuously as before. No eggs were laid before 5.00 p. m. Between 5.00 p. m., May 17 and 9.00 a. m., May 18, five eggs were laid. This and subsequent depositions are listed below. The eggs, in most instances were laid on the cloth, but occasionally were found on the chiffon of the floor or even on the sides of the box.

RECORD OF EGGS DEPOSITED BY ONE FEMALE *P. CORPORIS* IN WRISTLET

1918 Date	Time of Examination	Hours Since Last Examination	Number of Eggs
V-18	9.00 a. m.	16	5
19	12 30 p. m.	27½	13
20	9.30 a. m.	21	11
21	9 00 a. m.	23½	13
22	9 00 a. m.	24	13
23	9.00 a. m.	24	13
24	9 00 a. m.	24	13
25	9.00 a. m.	24	14
26	10.00 a. m.	25	13
27	9.30 a. m.	23½	14
28	9 00 a. m.	23½	13
29	9.30 a. m.	24½	14
30	9.00 a. m.	23½	12
31	9 00 a. m.	24	11
VI- 1	9.00 a. m.	24	13
2	10 30 a. m.	25½	12
3	9 00 a. m.	22½	11
4	9 00 a. m.	24	11
5	9 00 a. m.	24	12
6	9 00 a. m.	24	9
7	9 30 a. m.	24½	12
8	10.00 a. m.	24½	9
9	9 00 a. m.	23	8
10	9 00 a. m.	24	6
11	10 00 a. m.	25	1

Both the male and female were found dead on the morning of June 11. This record shows a total of 276 eggs deposited during a period of 25 days,—an average of 11 eggs per day and a maximum of 14 eggs in 24 hours. Of records previously published the one nearest approaching this is given by Nuttall, in which he obtained 272 eggs in 29 days, averaging 9.7 per day.

COÖPERATION AMONG AGRICULTURAL WORKERS

By JOHN J. DAVIS, *Lafayette, Indiana*

In his address before the Entomological Society of America at Philadelphia, Pa., December 30, 1914, on the Ecological Foundation of Applied Entomology,[1] Dr. S. A. Forbes said, "It is when we search for specific reasons for our successes here and our failures there that we are driven to a scrutiny and analysis of controlling conditions of every description, and so find ourselves involved in studies so far outside entomology, commonly so-called, that we are obliged to apply for assistance to the physiologist, and the chemist, and the physicist, and the meteorologist, and the geographer, and the agriculturist, and the animal husbandman, and the bacteriologist, and the physician, and the sanitarian, or in a word, to the ecologist, who from the nature of his studies, must, if he is thoroughly to cover his field, be something of each and all of these, and still something more." This thought so

[1] In Annals Ent. Soc. Amer., vol. 7, No. 1, Mar., 1915.

appropriately given has been a continuous reminder to the writer in his entomological investigations of the error we so frequently make in considering our problems from the narrow angle of our own particular field.

Agriculture is a study of the interrelations of all branches of agriculture, a complex of gigantic proportions and too great for the conception of a single mind. In the early days of scientific agriculture the workers were few and each was by necessity more or less acquainted with the most improved practices in all branches of agricultural work, as evidenced by the fact that the teacher of agriculture was frequently obliged to conduct classes in soils and crops, horticulture, animal husbandry, etc. To be sure he may have been especially interested in some phase of the subject, but nevertheless a general knowledge was essential. This plan of work has gradually changed until now we have the various investigations for each branch, and even these are subdivided and thus we have specialists for the various subdivisions. For some years, and especially since taking up intensive studies on insect problems of general farm crops, the writer has recognized the need of coöperation and freer intercourse between the different and increasingly complex branches of agricultural education. We feel that there is no more important work than the coördination of the many farm problems, and this cannot be treated as an individual problem but must be the combined work and ideas of complex investigations from every branch of the subject. Too often the entomologist in considering methods of control attacks the problems from the purely entomological standpoint, neither thinking nor apparently caring whether the suggestions may meet with the requirements of the approved plan of the agronomist, chemist or forester. Recommendations have been made seriously conflicting with approved farm practices which could doubtless have been revised to meet all requirements had the author been familiar with approved farm methods or better, if he had consulted with specialists in that phase of agriculture touching on his recommendations. It cannot be expected that an entomologist shall be familiar with all developments and approved practices in agronomy, nor the agronomist with problems entomological; but it is possible for the agronomists and entomologists, plant pathologists and entomologists, and others to freely consult on problems which are directly or indirectly connected and thereby reduce to a minimum conflict in advisory measures. The agronomist can see points of utmost importance in the control of insects which might never be considered by the entomologist, and the chemist would see features from his point of view which would be of invaluable help, and so on indefinitely, and it occurs to the writer that there lies within our reach a wonderful source of informa-

tion which would be made available by incorporating in our routine freer consultation with our coworkers, to say nothing of the benefit derived by securing recommendations of mutual value. Entomologists are not alone to blame for this condition; indeed they have in known cases endeavored to coöperate and seek advice from other branches of agriculture.

In our Hessian fly investigations we are dealing almost wholly with agronomic practices. Wheat sowing experiments have been started at various localities to determine not only the favorable date for sowing wheat to avoid the fly, but to determine the proper sowing dates irrespective of fly, and effects of quick-acting fertilizers on the crop to overcome injury or to permit sowing wheat after the fly-free date and avoid any possible harm often attributed to late sowing. Aside from sowing experiments plots where complete meteorological data are obtained, plots are grown to determine effect of time of plowing and cultivation of ground on resulting wheat crop in its relation to fly, effects of variously plowing the stubble to destroy fly, fly-resistant values of different varieties, et cetera, all of which are directly or indirectly of importance to the entomologist studying the Hessian fly, joint-worm and similar wheat pests and at the same time of equally great importance to the agronomist. Conversely the agronomist cannot lose sight of the insect problems in his investigations. We recently had the privilege of exhibiting and explaining results of our wheat sowing experiments to one of the best informed experts in soil and crop work, who after studying the results remarked that he could see how they might easily misinterpret results by failure to take into consideration the rôle played by insects. The interrelations between agricultural methods must be more closely studied as the problems become increasingly intensive, and to do this it becomes necessary that workers in different branches consult more freely and settle disputed or questionable points from the standpoint of agriculture in its broadest aspect. This was aptly illustrated in a recent conference at Washington, D. C. called by Mr. W. R. Walton, in charge of cereal and forage crop investigations of the Bureau of Entomology to consult with the Bureau of Plant Industry and secure their coöperation and advice on the suitableness of certain rotations which would enable the entomologist to recommend and insure a more universal practice of plowing under wheat stubble to destroy Hessian fly and joint-worm. This conference obtained for the entomologist recommendations which were agreeable to the crop experts and adaptable to the insect problems involved.

The individual investigator can most often plan his experiments from his own particular point of view and his knowledge of the prob-

lems to which it is related and can often continue it to a point nearing completion, varying according to the factors involved; but if the problem touches directly or indirectly on any related branch of agriculture he should under all circumstances, for the sake of uniformity, usefulness and stability, consult with his colleagues in that particular related branch for corroboration and advice. We have attempted to plan our work along these lines with favorable results. In the Hessian fly program the work was planned in accordance with the needs of entomology but the agronomist was consulted on points dealing with fertilizers, cultivation and the like for expert advice, and the practical and successful farmer similarly consulted for advice on the practical application of certain phases. In many of our investigations of farm crop pests, surveys have been made of one, two, or four square miles in infested districts, records being made of every possible factor which might be of importance in interpreting results, such as rotation, methods of cultivation and fertilization, possible barriers of timber or buildings, contour, meteorological influence and the like. These surveys have been mapped out and in the case of insects having a life cycle greater than one year, such as *Lachnosterna*, the records for the individual fields have been followed year after year, keeping even such detailed records as growth of vegetation on the ground at different seasons; for this little point is of much importance in considering subsequent infestations of white grubs if the observations are being made during a year when the parents of white grubs—the May-beetles—are abundant. A survey of this kind is of greatest importance in explaining the interrelations of the agricultural problems, and at the same time often shows by contrast just what conditions have affected one field in one way and an adjoining field differently, or have brought about an increase in insect pests in one and a decrease in another similarly located field.

The above discussion is intended to emphasize the need of keeping closely in touch with workers in all branches of agriculture and to encourage freer exchange of ideas and plans between agronomists, entomologists, plant pathologists, chemists, foresters, animal husbandmen, meteorologists and others. Likewise the agricultural investigator, and especially the entomologist, should not lose sight of the ecological applications for, as Doctor Forbes has said, the student in entomology should be required to complete certain courses in ecology as prerequisites to their courses in entomology, or at least ecology should be required as a necessary part of entomological training. This likewise applies to the agricultural student. He is required to complete certain courses in agronomy, chemistry, farm mechanics, animal husbandry, entomology, etc., and here his requirements end. He becomes familiar

with soils and crops from the point of view of the agronomist, with swine or poultry problems from the conception of one who has made a special study of these particular subjects, but the average student is not able to coördinate these studies as could be done if he had first obtained a knowledge of applied ecology in its relation to agricultural topics.

OBSERVATIONS ON THE SILK INDUSTRY IN CHINA

By C. W. Woodworth

One of the largest industries, at least from the standpoint of exports, is the production of silk. The great center of its production is the lower Yangtsee Valley between Nanking and Shanghai and southward to Hangchow.

I have had the opportunity of travelling over this whole district and while it was in midwinter I was still able to get a good idea of the extent of the industry and learn much about the practices.

Through this region the prevailing tree cultivated is the mulberry. The trees are small and planted quite thickly, perhaps ten feet apart, and kept cut back with the trunk seldom above six feet high, but not winter pruned. The trees are cut back during the summer at the close of the silkworm feeding season almost as severely as the short pruned grapevines and produce a fine growth of sucker-like branches, often 3–4 ft. long, before winter. It is from these that the leaves are gathered the following spring. During the winter these are often tied together and I am not sure that I know exactly what for; it looks as though it was to keep them up out of the way when cultivating.

Most mulberry orchards are well cultivated, but in many cases the trees are planted on and among graves, when they are not cultivated at all and it looks as though they did as well as any others.

During the feeding season mulberry leaves are sold on the streets, like vegetables and command a good price. Nearly every season there are not enough leaves to supply the worms grown. There is a movement on foot to greatly increase the planting of mulberries. The University has just planted about 15,000 cuttings to help in this work.

Because of the shortage of leaves, early hatching and small early maturing varieties are favored though they have the large French and Italian varieties in the schools. It seems hard to make the farmer see the advantage, they object that these big worms eat too much!

One of my problems is to see whether they are right. I have gathered together sixty-four varieties (some of which may be duplicates)

of eggs and propose to rear them in comparison with each other and then will know better which is most economical. I think the collection of eggs I now have is probably the largest assortment ever brought together and it is probable that I will have a great many more provided my plans of a short course on silk rearing are not prevented by war or pestilence which may be operating at once here in Nanking.

In any case, however, I expect to be able to rear the eggs that I have and we have secured the largest orchard of mulberries in Nanking or hereabouts and our supply of leaves is therefore assured. I estimate they will produce about three or four tons of leaves.

I have twenty lots of the common local strains of silk from as many localities. These are produced in the usual Chinese way and are untested for disease, which, I understand, is very prevalent. The remainder are produced according to the Japanese methods, which in turn were based on the methods devised by Pasteur.

The silk merchants have just established an organization for extending and popularizing the use of tested eggs in order to improve the quality of cocoons. Japan has increased her production of silk the last few years till it exceeds China's production and that ought to be enough to wake up the people of China to the realization of the need of better methods.

The Chinese government has established a number of silk schools and many agricultural schools in all of which, in this district, the rearing of silk and testing of eggs are taught.

I had the pleasure of visiting a new 50 basin filature just erected at Tangchow. The machinery was all Japanese and looked very satisfactory.

Japan is thus having a great and good influence on the silk industry of China, in the teaching at the schools, in the factories and in the spirit of emulation which her success in the silk industry has awakened in the progressive people among the Chinese.

CLYTUS DEVASTATOR, A NEW PEST OF THE FLORIDA ORANGE[1]

By E. A. Back, *Bureau of Entomology*

The insect discussed in this paper is not new to Florida. Neither is it new as a pest of *Citrus*, but it apparently has never before been recorded as a pest of the Florida orange. The purpose of this paper is to call attention to its capacity to injure orange trees in Florida should conditions become favorable for its increase.

[1] Published with the consent of the Secretary of the U. S. Department of Agriculture.

History of Infestation

During April, 1910, Mr. S. C. Cobb of Anna Maria Key, Florida, wrote to the Secretary of Agriculture that his attention had been called to the condition of an orange grove in his district that might assume a real menace to the orange industry of Manatee County; that without any apparent warning worm holes began appearing about six months previous in the bark of the trunk and limbs of certain trees, and that they continued to appear, even at the time of his writing, in spite of the fact that as the holes appeared they were promptly filled with sulphur and tar, and plugged with wood. Portions of branches, sent later to the Bureau of Entomology, were submitted to Mr. E. A. Schwarz who wrote Dr. L. O. Howard that the material "plainly shows that the apparently healthy wood of the orange branches in that section of Florida is attacked by a round-headed borer (family Cerambycidæ, order Coleoptera). This represents to my knowledge a new and apparently most destructive enemy to orange trees in Florida. There are only a few inside borers known among the Cerambycidæ, and the work in the sample sent by Mr. Cobb most closely resembles that of our common black locust borer (*Cyllene robiniæ*). There is very little doubt in my mind that this new orange borer belongs to the same genus. Should I be correct, there is in southern Florida only one species of this genus capable of doing this work, viz., *Cyllene crinicornis*, a species extremely common in the West Indies and throughout Central America, semitropical Texas and semitropical Florida." Under date of May 10, Doctor Howard wrote Mr. Cobb that it was Mr. Schwarz's fear that his trees were infested by a "hereto fore unrecorded and dangerous enemy of orange."

Investigation of Injury

At the request of Doctor Howard, the writer visited Anna Maria Key during the later part of May, 1910. On Perico Island, a small land area close to Anna Maria Key, four trees were found affected by borers, two very seriously so, as indicated by the illustrations of plate 1. The remaining trees of a small grove were unaffected. The two badly affected trees were so damaged by the borers that their owner had cut back the branches to mere stubs, and was willing to grub out the trees that a careful examination might be made of them.

It is doubtful if words can describe the nature of the injury better than the illustrations. The trees were small, scarcely seven inches in diameter and had evidently grown well previous to attack. The larvæ were found making their tunnels through all portions of the wood, and there were no evidences that their attack was of a secondary nature. When young, they feed upon the inner bark and sapwood, as shown

in figure 2 of plate 12, where their frass-plugged winding burrows stand out in contrast to the discolored sapwood. As they become older, they bore into the harder and older wood as showed by the sections of the trunk (Pl. 12, fig. 1). Not only were larvæ found working in various parts of the trunk and in the stubs of the larger branches, but even in the roots, both large and small. Fully half of the stump illustrated (Pl. 12, fig. 2) was beneath the surface of the ground, yet the removal of the bark brought to light the surface feedings of the young larvæ on the roots and the burrows of the older larvæ in the center of the roots, near the crown. The mature larva feeding in the hard wood, has the habit, similar to that of the round-headed apple-tree borer (*Saperda candida*), of eating its way to the surface, as indicated on the left of the cut surface of figure 12, plate 1, after which it retreats a short distance from the bark to pupate. The adult, upon emergence, gnaws a hole about three eighths to one-fourth of an inch in diameter in the bark and escapes.

Identification

Adults were reared and forwarded to Mr. Schwarz who at once pronounced them to be *Clytus devastator*, an insect first described by MM. Delaporte de Castelnau and Gory in 1836 (1), and named *devastator* because of the great injury it was known to cause *Citrus* in Cuba. The authors say "Le nom que nous lui donnons est tire de ses habitudes, ces insectes causant de grands degats aux citronniers." The adult beetles are normally a trifle over half an inch long, but vary greatly in size and in the color pattern of the elytra. The authors of this species give (1) an excellent colored figure of an adult which bears a pattern in white. The pattern of an adult reared from the orange tree at Perico and illustrated (Pl. 12, fig. 3) is one of many variations to be found in this species among the material of the U. S. National Museum.

Distribution and Hosts

The specimens of this species in the U. S. National Museum have been captured in Cuba at Cayamas (January, February, May, 1910, by E. A. Schwarz) and at Central Constancia (May, 1914, by J. F. Merrill); in Florida, at Palm Beach (May, 1903, by E. A. Schwarz), Key West (April and May, 1903, by E. A. Schwarz), Paradise Key (Royal Palm Park, May, by T. E. Snyder), Chase (March) and Perico Island at mouth of Tampa Bay (June, 1910, by E. A. Back).

At Cayamas adults were reared from "Cuban mahogany." The specimens from Chase, Fla., were reared from pomegranate (U. S. N. M., Hopk. No. 9902 i). The specimen from Paradise Key was caught

on the wing. Aside from the general statement made by Delaporte de Castelnau and Gory, and by D. Ramon de la Sagra (3) who says "Segun M. Laporte, este insecto causa grandes destragos en los limoneros," the specimens of the writer are the only ones reared from *Citrus*.

Conclusions

Clytus devastator, a Cerambycid borer, was first described as a serious pest of *Citrus* in Cuba in 1836, and has since been recorded by collectors besides in Cuba, at Key West, Chase, Paradise Key and Palm Beach on the East Coast of Florida, and at Perico Island, close to Anna Maria Key, at the mouth of Tampa Bay on the West Coast of Florida. It has been reared from "Cuban mahogany," pomegranate (*Punica granatum*) and *Citrus* (orange), and, according to Mr. E. A. Schwarz, has as its preferred host the common mangrove (*Rhizophora mangle*). Aside from the original statement that it was a serious pest of *Citrus* in Cuba, it has not been reared from *Citrus* until it was found damaging orange trees on Perico Island, Florida, in the spring of 1910. It has demonstrated its capacity to become a serious pest in Florida, and with the extension of the citrus industry still further south into more tropical portions of the state, or with a rearrangement of its host relationships following further development of the country, it may assume an important rôle as a pest of *Citrus*.

Bibliography

(1) Delaporte de Castelnau and Gory. Monographie du Genre Clytus, Rapport fait a l'Academie Royal des Sciences de France, dans la séance du 1 Janvier, 1836. p. 17, pl. 4, fig. 18 bis.

(2) Dejean. Catalogue des Coleopteres, 3rd Edition, 1837, p. 357 (*Clytus cordiger*).

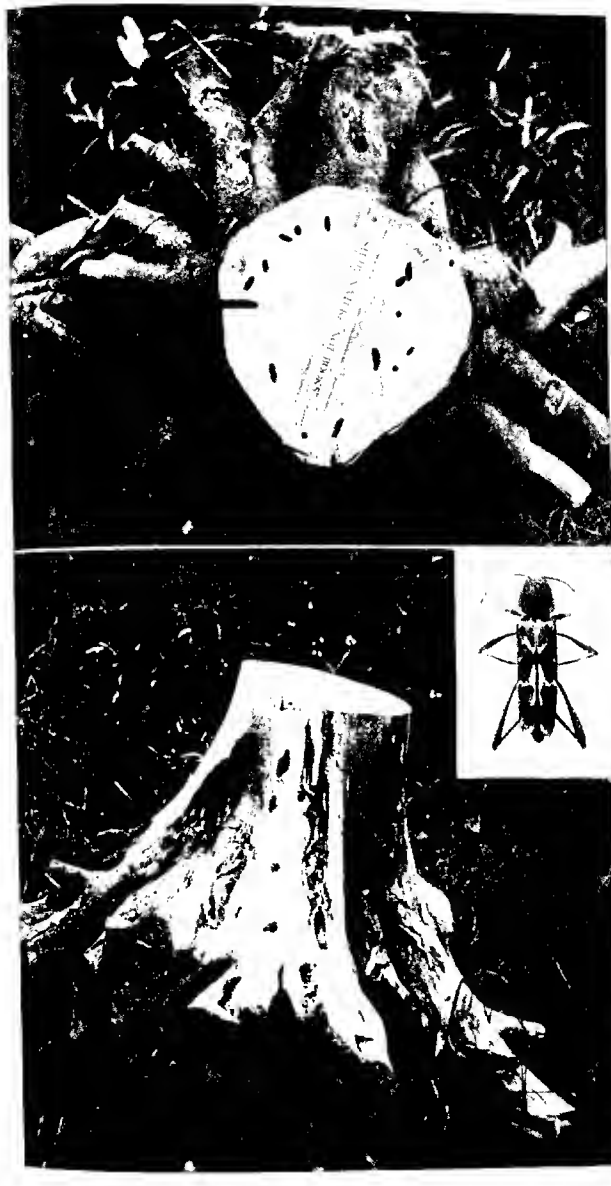
(3) D. Ramon de la Sagra. Historia Fisica, Politica y Natural de La Isla de Cuba. 1857, Vol. VII, p. 111. (*Clytus devastator*).

Explanation of Plate 12

Fig. 1. Cross section of trunk of orange tree showing the burrows of *Clytus devastator* and emergence hole on one of the large roots.

Fig. 2. Another view of same stump, showing not only the emergence holes of adults and the burrows of the more mature larvæ in the roots, but also the frass-plugged channels made in the sapwood by the younger larvæ. Note that secondary fungus attack has caused a discoloration of the sapwood near the burrows.

Fig. 3. Dorsal view of adult beetle, *Clytus devastator*, reared from stump. About twice normal size.



INSECT ENEMIES OF THE CHINCH-BUG

By W. P. FLINT, *Assistant Entomologist, Urbana, Ill.*

While the chinch-bug occupies a very prominent place in the writings of economic entomologists, up to the time of the discovery of its egg parasite, *Eumicrosoma beneficа* Gahan, by McColloch in Kansas in 1913, but very little detailed study had been given to its predaceous or parasitic insect enemies.

Walsh in some of his earlier writings on the chinch-bug says that it is attacked by four species of ladybugs, the most efficient being *Hippodamia maculata.*

Henry Shimer described in 1865 a new species of Chrysopa (*C. illinoiensis*) which he found in a cornfield feeding upon chinch-bugs, and reported that one of the larva of this species which he kept in confinement ate a dozen in quick succession. Later he reared *Hippodamia maculata* from egg to adult by feeding it upon nothing but chinch-bugs.

LeBaron mentions lace wing flies and ladybugs as the only insect enemies of the chinch-bug, but says that chinch-bugs are fewer than usual on hills of corn which have ant-hills at their base.

Thomas states that the chinch-bug is fed upon by *Hippodamia maculata.*

Riley says that the above mentioned insects feed upon the chinch-bug, and that he thinks ants are of some benefit in reducing its numbers.

Forbes found from an examination of the stomach contents of a number of the common ground beetles found in fields infested by the chinch-bug that about a fifth of the food of *Agonoderus pallipes* was derived from chinch-bugs.

Webster says that the chinch-bug has no insect enemies of importance; he mentions that it is infested by a species of Mermis or hair snake, and that its worst insect enemies are to be found in its near relatives, the insidious flower bug (*Triphleps insidiosus*) and *Milyas cinctus.*

Headlee and McColloch report that besides the above mentioned insects, they have occasionally seen the false chinch-bug, *Nysius angustatus*, feeding upon the chinch-bug, and have repeatedly found three species of ground beetles, *Harpalus compar, Ecarthrus sodalis,* and *Anisodactylus harpaloides* eating it. They also saw a cricket feeding on chinch-bugs and two of the small ants commonly found in grain fields, *Solenopsis molesta* and *Monomorium minimum,* carrying chinch-bug eggs and dead adults.

A few other insects have occasionally been found to feed on the chinch-bug but it has been generally supposed that predaceous insects are only a very slight check on its increase.

During the recent outbreak of this insect in Illinois (1909–1915) a number of observations on its predaceous enemies were made by the writer while conducting experiments on methods of chinch-bug control. In the summer of 1915 a number of insectary experiments were made to learn just how many chinch-bugs the more abundant of these predaceous insects would eat, and how common they were in the field. Those most commonly found feeding on the chinch-bug throughout the infested area in Illinois were adults and nymphs of the damsel bug, *Reduviolus ferus*, larvæ of Chrysopa and Hemerobius, adults of the small ground beetles, *Blechrus glabratus* and *B. pusio*, nymphs and adults of *Pagasa fusca*, larvæ of several species of Coccinellidæ, and nymphs and adults of the common flower bug, *Triphelps insidiosus*. The ground beetles most common in infested fields were not found to feed on chinch-bugs to any extent. *Casnonia pennsylvanica* ate small numbers of them and *Agonoderus pallipes* ate dead bugs and molt skins. Ants were never observed to attack living chinch-bugs in the fields although they would do so when the bugs approached an ant nest. Several of the species common in cornfields were noticed carrying dead bugs. Cincindelid adults were seen to eat small numbers of chinch-bugs along barrier lines.

The following notes give the detailed results of the studies of the above mentioned insects. In these experiments single specimens of the predaceous insects to be tested were placed in clean vials with a known number of chinch-bugs of known stages of growth. A few sections of foxtail grass were also placed in the vials as food for the chinch-bugs, and the vials stopped with cotton. These vials were examined daily and fresh food for the chinch-bugs added and fresh bugs as needed. By the use of check vials in which only chinch-bugs were confined, it was found that they could be kept in a normal state of growth in this way, several lots being carried through from egg to adult.

Chrysopa oculata and *C. rufilabris*. Chrysopa larvæ were abundant in all fields of grain infested by the chinch-bug. They were often seen feeding on chinch-bug nymphs especially in cornfields where they would be found behind the boots of the lower leaves where the chinch-bugs were most abundant. In a number of cases chrysopa larvæ were seen to suck from three to five chinch-bugs in the course of ten minutes. The insectary experiments were first started with chrysopa larvæ collected in the field in different stages of growth, but were later carried on with larvæ hatched from eggs in the insectary.

These experiments showed that where first and second instar chinch-bugs were offered as food, the chrysopa larvæ ate from four to six per day and that about 100 of these nymphs would be required for the chrysopa to complete its growth from egg to adult. Counts made in cornfields after the first of August showed that chrysopa larvæ would average about six per hill of corn in fields where chinch-bugs were abundant.

The damsel bug, *Reduviolus ferus*. During the past chinch-bug infestation this insect has been noted as probably the most common of any of the insects feeding upon chinch-bugs in all situations.

Insectary experiments with this species showed that both nymphs and adults fed readily on chinch-bugs, that they seemed to prefer chinch-bug nymphs in the third or fourth instar and occasionally fed on adults. An average of about two chinch-bugs per day were eaten where the observation extended over a period of two to three weeks.

Blechrus glabratus. This small, very active beetle apparently feeds only on chinch-bugs in the first and second instars, its size making it very difficult for it to overpower the larger bugs. In the insectary experiments one of these beetles ate eighty-eight chinch-bugs in twenty-six days. In another case eighteen first instar chinch-bugs were eaten in twenty-four hours.

These beetles can be found in the adult stage in all grain fields after the middle of June. They have been taken in fairly large numbers in the hibernating quarters of chinch-bug, especially in the bases of the large clump farming grasses.

Another fairly efficient chinch-bug predator, although not occurring in grain fields in very large numbers, is the Nabid, *Pagasa fusca*. All stages of this insect from small nymphs to adults have frequently been seen in infested fields feeding upon the chinch-bug. In the insectary experiments with this insect all specimens used died during the molting process although in some cases one or two molts were successfully completed. For this reason no complete records of the number of chinch-bugs eaten by individuals of this species was obtained. This insect seems to prefer the later stages of the chinch-bug and has been seen a number of times in the fields feeding upon adults.

In the insectary experiments this species ate from one to two chinch-bugs per day for a period of from five to thirty-six days.

During the hatching period of the second brood of chinch-bugs one of the most efficient of their enemies is the predatory flower bug, *Triphleps insidiosus*. This insect has been seen in small numbers in infested fields of small grain but has been found in abundance in the cornfields during late July, August and September. The small size of this insect makes it impossible for it to feed upon any but first

and second instar chinch-bugs; both nymphs and adults have been seen a number of times in the field feeding on the early stages of the chinch-bug. In cornfields it would sometimes be found to average five and six to the stalk of corn over the entire field.

The insectary experiments with this species showed that about twelve first instar chinch-bugs were required for the flower bug to complete its growth to adult, and that these were taken at the rate of a little less than one per day. Their appetite for chinch-bugs did not decrease when the adult stage was reached as they still continued to feed at about the same rate as the nymphs.

Only two of the ground beetles common in the chinch-bug infested field could be induced to feed upon chinch-bugs in the course of the insectary experiments. *Casnonia pennsylvanica* has been seen feeding upon chinch-bugs in the stubble fields but only in one or two cases during the past five years. The results of the insectary experiments do not show that this beetle would be of much importance in reducing the number of chinch-bugs in an infested field. One specimen ate ten chinch-bugs in forty-eight days, another eight during the same period, while a third only ate five in forty-two days. Only chinch-bugs in the later stage of growth were eaten.

The small striped ground beetle, *Agonoderus pallipes*, is very common in all grain fields in the central and southern part of Illinois but was never seen to attack living chinch-bugs in the field. In the insectary experiments with this species one beetle under observation for fifty-five days ate seven dead chinch-bugs but would not attack living bugs although confined with them for this entire period. Another specimen of the same insect kept under the same conditions for eighteen days ate one dead chinch-bug and one cast molt skin.

In the field larvæ of Coccinellids were frequently seen to feed upon chinch-bugs. Several attempts in the insectary to get the number of chinch-bugs eaten by the different species of these larvæ were without definite results. The Coccinellids were never contented in any of the several types of cages used and spent nearly the entire time trying to get out, all dying within a week. A few chinch-bugs were eaten by them however.

Experiments with a few other species of ground beetles found in the chinch-bug infested fields did not show that these insects fed upon chinch-bugs.

To try and get a definite idea of the abundance of the chinch-bug predators in the fields counts were made of the number of these insects occurring in a measured square yard of stubble in a number of fields in central Illinois during July. On the average enough predaceous insects of the above species were found to eat eleven chinch-bugs per

day per square yard, or about two million per day for a forty acre field; this estimate being based on the results of the above insectary feeding experiments where only chinch-bugs were offered as food.

In the above counts it should be kept in mind that certainly not over one-half and probably not over one-third of the *Blechrus* present were counted. This insect is very active and seeks to hide on the least disturbance and its small size renders it very hard to see. The same is also true of *Pagasa fusca*. While in this case the insect is somewhat larger it is even more easily alarmed. Even the numbers of predators shown in the above counts however would easily account for ten chinch-bugs per square yard per day.

Fifteen bunches of grass in a moderately infested cornfield were carefully examined and yielded four hundred fifty-four chinch-bugs, two ladybugs, three Reduviolus, five predatory flower bugs and five Chrysopa larvæ, or enough predatory species to account for at least twenty chinch-bugs per day.

During the entire month of August, 1915, examinations made in cornfields in west central Illinois showed the predatory flower bug often averaging five to six per stalk of corn and Chrysopa larvæ, nymphs and adults of *Reduviolus, Pagasa fusca* and adults of *Blechrus* abundant in all chinch-bug infested fields.

It seems probable from the abundance of these insects in the fields and the numbers of chinch-bugs known to be eaten by them that when after a period of abundance the chinch-bug increase is checked by adverse weather conditions, that these predatory species together with the egg parasite may keep them from causing damage for a number of years. During the season of 1917 with a wide area in Illinois dangerously infested with chinch-bugs no marked damage has been done partly because of the abundance of these predatory species in the fields. *Reduviolus* and *Pagasa fusca* have been unusually abundant in chinch-bug infested fields during the past summer.

A NEW SPECIES OF SCIARA BRED FROM RED CLOVER CROWNS

By F. W. Pettey, *Cornell University, Ithaca, New York*

Professor A. C. Burrill of Moscow, Idaho, has sent to the Department of Entomology of Cornell University, some specimens of a *Sciara* reared by him from red clover crowns. An account of the life history of the insect by Professor Burrill will follow this article. The species is apparently undescribed.

Sciara trifolii n. sp. Male. Length 1.2 mm. Head black; antennæ fuscous, over two-thirds the length of the body. Thorax; mesonotum piceous, shiny, pleuræ fuscous. Abdomen black, intermediate segments with anterior two-thirds fuscous, hairs pale yellow; hypopygium brown, near its base with a small median ventral lobe (Fig. 15, b) margined with about 8 setæ; clasper (Fig. 15, a) with an apical tooth, and with about 4 stout, subequal, scattered spines and with one proximad, longer, more slender spine along the inner margin. Coxæ and palpi luteous; trochanters black; tibiæ dull yellowish-brown; tarsi fuscous to black; hind tibia and tarsus about equal in length. Wings hyaline; veins brown, rather strongly marked; media and cubitus without setæ; petiole of cubitus less than one-half the length of the base of media; R_1 ends at least one-sixteenth of the wing length proximad of the forking of M; the base of R_5 distad of the mid point between the humeral cross vein and the tip of R_1; M_2 ends distad of the termination of R_5. Twin Falls, Moscow, Idaho. October 3, 1917. Figures a and b are magnified 300 diameters.

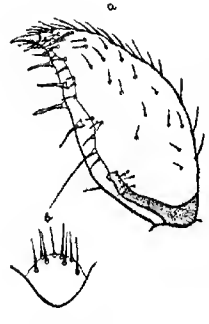


Fig. 15. *Sciara trifolii*. *a* clasper, *b* lobe of hypopygium (Original).

Female. Length 1.5 mm. Colored like the male. Moscow, Idaho. (See Pl. 13, Figs. 3 and 4 for wing venation.)

This species is closely related to *S. paucicta* Felt, from which it may be distinguished by the characters of the hypopygium and the more retracted position of the tip of R_5.

Described from 2 males reared October 27, 1916 and October 3, 1916, and 10 females reared October 27, 1916, from the crowns of red clover, Moscow, Idaho.

Types in the Cornell University collection. Co-types in the Idaho Agricultural Experiment Station collection.

1. *Aphelinus bajsligni* How., dorsal and side views. 21 diam. 140X.

2. Ditto, ventral view in balsam, wings and ovipositor extended. 34 diam. or 1200X. Bred from *Aphis baccri* Cowen.

3. *Scirta vitfoiti* Pett., wing of female. 34 diam. or 1200X.

4. Ditto female in side view, balsam mount. 21 diam. or 140X, a new species bred from red clover roots, Twin Falls, Id.

NEW ECONOMIC PESTS OF RED CLOVER[1]

By A. C. BURRILL, *Entomologist, Moscow, Idaho*

The third successive epidemic of the clover aphis (*Aphis bakeri* Cowen)[2] in Idaho in 1916 reduced considerably the seed yield in red clover, and also in white and alsike clovers. In one 40-acre irrigated field, which should have gone 10 bushels (some go 15 bushels) to the acre, the yield was 5 bushels to the acre, a loss of over $1,600. The average condition on some 60,000 acres throughout the State is estimated thus:

Variety of Clover[3]	Yield in Bushels per Acre			
	1914	1915	1916	1917
Red	8	6	2–4	4–5
Alsike	7	7	6	?
White	6	6	6	6

In 1917, a January zero spell following after excessive numbers of aphis enemies, seems to have released the 1917 crop from excessive damage.

Where the clover heads are very sticky from aphis, preliminary thorough drying is necessary before the seed will thresh. Usually the heat of the threshing melts the crystallized honeydew so that whole sacks may cake nearly solid. This phenomenon is also seen in the heap of weed seed sifted from the thresher separator. On first test, this sticky seed germinates better than well-dried unaffected seed. Idaho produces the best colored seed in the world and the best in price and yield per acre. Clover is no doubt the key crop in rotation with war wheat, and its enemies are thus of present importance.

The enemies of this aphis are very numerous but their ability to check the epidemic seems to be nil until the third or fourth week in August, when the crop damage is almost complete. By that time the chaff and stems gather on the cutter blade of the mower, making delays for frequent cleaning advisable. The larval Coccinellids in the fields in August have bred out mostly *Hippodamia 5-signata* Kirby, *H. convergens* Guerin, *H. lecontei* Muls., and *Coccinella trifasciata* L., but they and their adults appear to be unable to penetrate all parts of the clover head to destroy every last aphis. And thus, a head may come to have as high as 300 aphids before enemies gain the upper hand,

[1] Published with the permission of the Director (J. S. Jones) Idaho Agr. Expt. Station. First presented as a paper at the Dec., 1916, meeting of the Am. Assn. of Econ. Entom., New York, N. Y., under the title "Insects of the Year in Idaho"; publication delayed for specific determinations.

[2] J. J. Davis, det.

[3] Id. A. E. S. Bul. No. 100. Clover Seed Production. L. C. Aicher. June, 1917.

a rate of infestation twice as great as the number of seeds produced by a normal head. In some fields where such heavily infested heads occur, the pedestrian will get his trouser legs very sticky on a level with the excessively sticky clover blossoms. Adjoining clover fields which have been cut at a slightly different time will have so few aphids or honeydew, that much destruction of the aphis evidently follows from the curing of the hay in the sun.

The most abundant Syrphid flies have been reared and await determination. Far more numerous than these are the new species of Hymenopterous parasites (*Aphelinus lapisligni* How.) discovered independently by Mr. L. R. Rockwood and myself, mine having been first considered by Dr. Howard as either a different variety or a still different species.[1] (See Pl. 13, figs. 1 and 2.) Seldom more than ten of this parasite occur per head of clover, and the parasitized jet black aphids appear more often in the lower leaf petiole bracts sheathing the stem than in the head, indicating an earlier attack of the parasites, before the clover blossom heads form. This also indicates that on some plants, the aphis infestation proceeds perhaps from apterous female aphids overwintering next the crown.

Quite as numerous in some fields are the orange-yellow nymphs of the Western Dark Triphleps (*T. tristicolor* White), averaging from one to three individuals per clover head. These rapidly and more persistently penetrate all parts of the clover bloom and stem than all the other aphis enemies combined.

Preliminary tests with orchard sprayers driven through the fields have shown that a majority of the aphids may be destroyed with nicotine sulfate and soap at usual strengths. We had thought to chronicle the discovery that Syrphid larvæ and Triphleps nymphs, together with the adults of Syrphids, Coccinellids, Triphleps, and honey bees are little affected by this spray, appearing to be as lively as ever two to three days after application. However, in Maine Bulletin No. 253, p. 221, Metcalf has laboratory proof of the survival of Syrphid larvæ so sprayed. I have since found that where adult *H. convergens* are confined in small capsules of sprayed leaves, they die. After the spraying, natural enemies gain the upper hand.

Sodium arsenite sprayed by orchard or field sprayers (formula based on that in Wisconsin—J. G. Sanders) has proved 99 per cent efficient against grasshoppers in many alfalfa and clover fields of all ages of growth; and the addition of nicotine for aphis does not make it burn worse. Over 20,000 acres were sprayed with arsenite, I was told, under the direction of the County Agents in 1916, but too much burn-

[1] Howard, L. O. Proc. Biol. Soc. Wash., Mar. 31, 1917. Vol. 30: 77–8; personal correspondence.

ing resulted in some cases. Insistent demands of beekeepers that these sprays may kill off their bees, are hard to set at rest until a long series of toxicity tests in the honey bee has been followed out in line with the excellent Federal contributions.[1]

The part which thrips play, the red or black species (*Haplothrips slatices* (Haliday), syn. *Phlaeothrips niger* Osb.[2]) in the clover and alfalfa seed loss is not understood. In July, 1917, Mr. A. H. Harrison and I watched under a hand lens how these species scarify the floret envelopes of clover blooms towards the floret bases.

Frequent requests for data about mites on clover crowns, also on potatoes, dying tree trunks, etc., failed to bring to light any one species as primarily to blame, other than that *Rhizoglyphus rhizophagus* Banks[3] is most common, some immature gamasids of the Uropodidae and *Hologamasus inarmatus* n. sp.[4] The widespread death of red clover crowns after cutting the seed crop infested with aphis, has been blamed to *Aphis bakeri* Cowen, but recent rearings from infested crowns in the same area, of numbers of a new species of Sciara (*S. trifolii* Pett. near *S. varians*[4] indicate other contributory causes. The mites befouled other tests as follows:

Received red clover roots swarming with black-headed, white maggots and white mites, September 30, 1916 from field 4m. NW of Twin Falls, Idaho, with a note to the effect that whole fields of clover were dying, following the clover aphis epidemic in August and cutting the seed crop about September 1. Ewing determined the mite as *R. rhizophagus* and adults from maggot are described above as the Mycetophilid, *Sciara trifolii* Pett. Under careful watering, the supposed dying clover crown was revived so as to send out new sprouts and insects were reared as follows:

October 3, one adult had emerged.

October 23, 1916, first dozen adults appeared; last one died November 11.

November 23, 1916, second brood adults appeared; last one died November 30.

December 24, 1916,[5] third brood adults appeared; last one died January 8.

[1] N. E. McIndoo. Sense Organs, etc., Honey Bee. Smiths. Misc. Coll. Publ. No 2381: McIndoo. Effects of Nicotine as an Insecticide. Jour. Ag. Res., Oct., 1916. Cf. C. W. Mally, arsenicals did not hurt bees. Agr. Jour. Union of So. Afr., June, 1909.

[2] J. D. Hood, det. in letter, Feb. 25, 1918.

[3] H. E. Ewing, det.

[4] Through courtesy of Prof. O. A. Johannsen, described in preceding note by F. W. Pettey, Cornell Univ.

[5] Figs. 3 and 4 are made from female of Brood III presumably.

February 4, 1917, fourth brood adults appeared; last one died March 10. Meantime, mites swarmed on root and stem, and the plant soon wilted beyond revival. It seemed to be impossible to get any clover material started for tests without having it fouled by the above mite sp.

August 31, 1916, another sending of dying red clover crowns from the Twin Falls South Side tract yielded the same mite and a new species, *Hologamasus inarmatus* Ew. Although coaxing this clover crown into growth, it soon wilted under the mite attack presumably, no maggots being present. A heavy teaching schedule prevented detailed life-history work, but Sciarid larvæ have been preserved in balsam. If by chance *R. rhizophagus* is found to have habits as notorious as the bulb mite, *R. hyacinthus* Boisd., clover in irrigated sections will need further study.

An unexpected setback overtook operations by growers in spraying nicotine and soap for bean thrips (*Heliothrips fasciatus* Perg.). At the usual strength and put on with an orchard power sprayer, this insecticide failed to wet a large part of the infestation. A visit later showed that a concurrent attack of red spider mite (*Tetranychus telarius* L.) had so webbed the leaves as to protect large numbers of thrips from a wetting. Large losses in beans from this epidemic occurred throughout Idaho in 1916 but not in the backward season of 1917. Field crop losses in Idaho run into the millions annually, and though figures have been compiled, I hesitate to give them.

EXPERIMENTS ON COCKROACH CONTROL

By E. V. Walter, *Ames, Iowa*

Poison and traps of various kinds have long been used for cockroach control. At best traps cannot be relied upon as a means of extermination, since they only alleviate conditions. Certain proprietary roach poisons on the market have given good results but these are all high in price. Moreover cockroaches are so wary that, when a few have been poisoned, others will not feed unless starved to it.

The material for this article is taken from notes by the writer while employed as an assistant in the Entomology Section, Iowa Agricultural Experiment Station, in the summer of 1917. The work was undertaken at the suggestion of R. L. Webster when the manager of a local cafeteria called for assistance in controlling cockroaches.

J. A. Lintner[1] seems to be the first writer to tell of the use of borax

[1] Injurious Insects of New York. First Report, 1882, p. 343.

and mentions having killed many roaches with this material. Since that time powdered borax and powdered sugar, mixed in equal parts, have often been recommended, possibly more than any other materials, since these are nonpoisonous to human beings. Powdered borax and powdered sugar were first used at the cafeteria but gave no relief and no dead roaches were observed after using.

Traps were used at the same time as the borax. These were made by inserting a paper cone, tipped with hair, into a flat bottom flask. The flask was laid on its side, using banana peeling as bait within. This differs from the Graham roach trap described by Washburn,[1] since it has only a single cone with a row of bristles at the small end. The Graham trap has a double cone with bristles on the small end of the inner cone.

Two traps were placed beneath the steam-heated serving table in the cafeteria. Trap No. 1 was in a place where diffused light from a window would strike it by day and indirect artificial light would strike it in the early part of the night. Trap No. 2 was in the dark day and night. Other conditions, so far as observed, were equal. Collections were made from the traps at ten o'clock each morning. The hair on the cones did not entirely prevent the escape of the roaches and, as they avoid light, the wide difference in results may be partly explained in this way. Most of the roaches caught here were *Blatella germanica* although *Blatta orientalis* seemed to be fully as abundant in the building.

TABLE NO. 1. COCKROACH TRAPS IN CAFETERIA

	Trap No. 1 (In light)		Trap No. 2 (In dark)	
Date	Adults	Nymphs	Adults	Nymphs
June 9	3	1	1	28
June 10-11	0	0	7	108
June 12	0	4	3	96
June 13	4	18	15	133
June 14	0	26	3	111
June 15	0	49	7	87
June 16	0	18	1	63
June 17-18	0	203	4	279
June 19	1	39	2	167
June 20	0	15	1	100
June 21	0	32	0	331
13 days	8	405	44	1,503

While the traps were being used a new manager took charge of the cafeteria. When he saw conditions this new manager wrote to an agent of a roach poison company who guaranteed to rid the place entirely in thirty days. Arrangements were made for the employment

[1] Journal of Economic Entomology, vol. 6, p. 327, 1913.

of this agent, who used a white powder, scattering this every place that the cockroaches frequented. This agent would not tell what the powder contained, nor would he sell it, insisting on doing the work himself. The next morning after the powder was scattered on the shelves, floor and in all corners, the floor was literally covered with dead and dying roaches and within a week's time scarcely any could be found, a few days later none at all. Very few roaches were found several weeks later but these may have come in afterwards. The writer scraped up some of this powder and turned it over to Dr. S. B. Kuzirian of the Chemical Section of the experiment station for analysis. His report shows that powdered boric acid was the only thing found.

August 22 a mixture of powdered borax and powdered sugar was again tried in the kitchen of a sorority house. After three days no dead roaches could be found, although they were seen in the mixture and under papers where it was scattered. On August 25 this mixture was removed and powdered boric acid scattered on the shelves and floor. The next morning a number of dead roaches were seen and at the end of ten days only one live roach could be found. None at all were observed on later visits. Boric acid was again tried in the dispensary room of the bacteriology department of the college, with even better success. After four days only one roach could be found and none on later visits.

At another time boric acid was tried on a larger scale in a large grocery store and basement. Although the work here was not done thoroughly enough to completely rid the place of roaches, yet their numbers were greatly reduced. So quickly and effectively did the boric acid work that twenty dead and dying roaches were picked up behind one fifteen foot counter half an hour after it was placed there.

These tests showed the effectiveness of boric acid. Further trials were made to determine how the roaches obtained the material and also to determine further if powdered borax and powdered sugar would not work as effectively. More roaches were trapped and confined in battery jars in the insectary in making further trials.

On one occasion after boric acid had been used at the sorority house one healthy roach and one nearly dead were picked up and placed in the same jar. They were given no food and left undisturbed. One died later in the day but was not removed. Three days later the remaining healthy roach ate the stomach and intestine of the dead one and died in a short time.

This showed that cockroaches ate the boric acid and that, after killing one individual, the boric acid might still be fatal to others. To test this point further five roaches, recently killed with boric acid, were thoroughly washed and the stomach and intestines removed and

placed in a battery jar with six healthy roaches. Within four days all of the intestines had been eaten and four roaches had died. The two remaining were not affected, although retained in the jar fully a week longer.

From this work it was seen that boric acid readily killed cockroaches upon eating it. Would they eat it more readily if mixed with powdered sugar? In another experiment eighteen roaches were placed in each of two battery jars and the powder placed at one side of the jar. No difference was observed in the effectiveness of boric acid used alone or mixed with sugar. The roaches were placed in the cages at 5.00 p. m. September 12 and by noon September 14 all were dead in both jars.

TABLE No. 2. BORIC ACID ALONE COMPARED WITH BORIC ACID AND POWDERED SUGAR.

	Boric acid alone	Boric acid and powdered sugar
Sept. 12, 5 p. m.	Experiment started	
Sept. 13, 8 a. m.	7 dead	7 dead
12 noon	5 dead	3 dead
4 p. m.	1 dead	2 dead
Sept. 14, 8 a. m.	4 dead	5 dead
12 noon	1 dead	1 dead
Total	18 dead	18 dead

Up to this time the powdered borax and powdered sugar mixture had been used by the writer only in the open and apparently without success. Thirty roaches were now placed in each of two jars. Borax and sugar were placed in one, boric acid in the other, each at one side of the jar. This was to determine whether the borax mixture would kill the roaches and also to determine the length of time required to kill all the roaches in each case. In this experiment all the roaches in the cage with the boric acid were dead after four days, while it required thirteen days to kill all of them with the borax. Sixteen roaches in the cage with the borax were dead at the end of four days. The sugar caused the mixture to become more compact, evidently retarding its action. No other food was given in either cage.

A few days later the same experiment was repeated using thirty roaches in each cage as before, this time introducing a banana peeling, of which roaches are very fond, into each of the two cages. The powder was placed in a watch glass so that the roaches had free access to it, but need not necessarily get into it. In this case the boric acid killed all roaches in four days, while it took fourteen days to kill them with the borax. Dr. Geo. D. Shafer[1] has shown that borax also acts as a

[1] Technical Bulletin No. 21, Mich. Agr. Coll. Exp. Station, p. 54, 1915.

contact insecticide killing the roaches in two to ten days through contact of the powder alone.

TABLE No. 3. BORIC ACID AND BORAX AND SUGAR COMPARED

	Without other food		With other food	
Date	Boric acid	Borax and sugar	Boric acid	Borax and sugar
Sept. 13		Exp't started		
Sept. 14		0 dead		
Sept. 15		2 dead		
Sept. 16		14 dead		
Sept. 17		3 dead		
Sept. 18		4 dead		
Sept. 19		0 dead		Exp't started
Sept. 20		0 dead[1]		0 dead
Sept. 21		1 dead		3 dead
Sept. 22		3 dead		5 dead
Sept. 23		1 dead		6 dead
Sept. 24		1 dead		3 dead
Sept. 25	Exp't started	1 dead	Exp't started	0 dead
Sept. 26	2 dead	Total 30	2 dead	0 dead
Sept. 27	13 dead		19 dead	0 dead[1]
Sept. 28	12 dead		9 dead	6 dead
Sept. 29	3 dead		Total 30	1 dead
Sept. 30	Total 30			0 dead
Oct. 1				0 dead[1]
Oct. 2				6 dead
Oct. 3				Total 30

At another time pieces of apple spread with borax were placed in a cage containing 126 roaches that had been without food for twenty-four hours. This was to determine the length of time required to kill the roaches when they were forced to eat borax in order to obtain other food. In this case eight days were required to kill all the roaches, although most of them were dead within the first four days.

TABLE No. 4. BORAX SPREAD ON APPLE

Date	No. of roaches dead and removed
Sept. 20	Experiment started
Sept. 21	14
Sept. 22	57
Sept. 23	29
Sept. 24	20
Sept. 25	4
Sept. 26	1
Sept. 27	0
Sept. 28	1
Total 8 days	126 roaches

[1] On these dates the borax and sugar mixture was stirred up in order to freshen it. Apparently this made it more effective for more dead roaches were found soon after.

The habit of extreme personal cleanliness was observed shortly after the work was begun with roaches confined in cages. This interesting habit, also observed and recorded by Dr. L. O. Howard[1] and Dr. Geo. D. Shafer[2] throws a great deal of light on the reason for roaches eating boric acid.

A cockroach covered with dust or dirt will, when unmolested, begin a process of cleaning. Usually it draws first one antenna after the other slowly between the mandibles, then begins on the legs, later the abdomen, doubling up almost into a ball until it cleans itself thoroughly. Boric acid being a very fine, light powder, readily adheres to the roach and must be cleaned off. The powdered borax and powdered sugar mixture is heavier, and readily hardens if moisture is present, so does not stick as well. The writer has never observed roaches eating either the borax and sugar mixture or boric acid except in their efforts at cleanliness. Boric acid has no effect on the eggs already deposited so unless the powder is left on the shelves for a considerable time, treatment must be repeated after a few weeks.

Prices for boric acid vary greatly at the local drug stores. This year (1917) it was purchased at 30 cents per pound. The New York wholesale market report for November 20, 1917[3] gave the price of powdered boric acid at 13½ cents per pound. Sodium fluorid, which is also used to kill roaches, is quoted in the same Journal at 18 to 19 cents. Sodium fluorid was much higher in price than boric acid so was not used in this work.

Summary

1. Traps may be used as means of control but cannot be relied on as a method of extermination.

2. Boric acid is a safe and economical material to use against the roaches as it is nonpoisonous to human beings and yet very effective against roaches.

3. A mixture of equal parts of powdered borax and powdered sugar ground together is effective against cockroaches, is safe and economical, although acting slower than boric acid.

4. Cockroaches eat these substances in an effort to keep clean and not for any possible food value.

[1] The Insect Book, p. 331, 1902.

[2] Technical Bulletin No. 21, Mich. Agr. Coll. Exp. Station, p. 55, 1915.

[3] Journal of Industrial and Engineering Chemistry, December, 1917.

NOTES ON A NEW MITE ATTACKING VALLEY COTTONWOOD

By P. J. O'Gara, *Director, Department of Agriculture and Smelter By-Products Investigations, American Smelting & Refining Co., Salt Lake City, Utah*

On May 12th of this year while examining some poplar trees (*Populus wislizeni* S. Wats. Sarg.) near El Paso, Texas, a very interesting infestation of mites was noted on the current year's growth.

On the accompanying photograph, Plate 14, the normal foliage of the tree is shown at the top, while below is shown the work of the mite. Here the leaves which should have normally grown at the ends of the petioles have been very much dwarfed and cut. The general appearance is very much like a dense inflorescence such as one would see in plants which produce a large number of floral elements. The photograph so well illustrates the appearance of the infestation that an extended description is not deemed necessary.

Examination of the affected leaves revealed a very small mite, measuring approximately one-tenth of a millimeter long, its width being about one-fourth of its length. Specimens were sent to Dr. L. O. Howard of the United States Bureau of Entomology with the following note: "The Pathologic condition of the specimen indicates to me an infestation of some species of mite, perhaps an *Eriophyes*."

Dr. Howard referred the specimen to Prof. P. J. Parrott, who reports, through his assistant Mr. H. E. Hodgkiss, that the mite is a new species of *Eriophyes* which has not been heretofore described. He also indicates that the type of injury produced by the mite is new.

Work of eriophyes sp. on valley cottonwood. original

Scientific Notes

European Potato Wart Disease. Recent advices report the discovery of this disease in ten small mining villages near Hazleton, Pa. The Pennsylvania Inspection Service is coöperating with the Federal Horticultural Board in handling the situation. The Pennsylvania horticultural law gives adequate quarantine power.

Lopidea media, a persistent pest of phlox. For a number of years the writer has noticed the phlox plants of certain gardens of Fayetteville, Ark., to be infested by a Capsid which Mr. Chittenden has determined for us as *Lopidea media*. The insect seems to occur only in certain gardens but in these gardens it is a very persistent pest and makes its appearance every year. This bug causes the tender tips and the leaves of infested plants to curl, and the plants take on a sickly yellowish-green appearance. In some gardens phlox growing has been abandoned because of the bug. In 1917 adults of the first generation were found by May 5 though most of the bugs were still in their nymphal stages by this time. It would seem that there must be at least three generations a year in this latitude.

GEO. G. BECKER,
Agricultural Experiment Station, Fayetteville, Ark.

Cannibalism in Euetheola rugiceps Lec.? In some material which was sent the writer from Newport, Ark., in 1915 one beetle was observed to have been partly devoured by another. The partly devoured beetle had one of its elytra eaten off and when it came to the writer's attention, it consisted of nothing but a hollowed-out, chitinized shell. A beetle had its head deeply buried in the back of the dead specimen, and was apparently feeding very ravenously as it was separated from the dead specimen with difficulty. Whether the partly devoured beetle died en route and was subsequently attacked or whether it was attacked while alive cannot be determined

GEO. G. BECKER,
Agricultural Experiment Station, Fayetteville, Ark.

A Second Food Plant for the Cherry Leaf-Beetle. In the recent economic literature pertaining to the Cherry Leaf-Beetle, *Galerucella cavicollis* LeC. such as the following:

"Observations on the Life-History of the Cherry Leaf-Beetle," by Glenn W. Herrick and Robert Matheson, in Journ. Agr. Research, Vol. V, No. 20, Feb. 14. 1916, pp. 943-950, and

"The Cherry Leaf-Beetle," by F. Z. Hartzell, Bull. No. 444 (Dec., 1917), N. Y. Agr. Expt. Station, Geneva, N. Y., statements are made that so far as known, the only native food plant of this beetle is the pin cherry, *Prunus pennsylvanica* L. I can add a second. While collecting in the Black Mountains of North Carolina, in July, 1902, I found this beetle feeding in numbers on the leaves of the fire azalea, *Rhododendron calendulaceum* (Mich.) G. Don., and though wild cherry, presumably the pin cherry, was found in the neighborhood, did not take it upon that. While at Ithaca, N. Y., during the summer of 1917, I took this beetle in great numbers from the pin cherry and also found it again feeding on the leaves of a species of azalea. The azaleas were not in the neighborhood of any wild cherry trees that I could see.

EDWIN C. VAN DYKE.
Berkeley, Cal., Sept. 3, 1918.

The European Earwig. Mr. Essig's recent note (p. 338) leads me to record that I found a living specimen of *Forficula auricularia* while unpacking tulip bulbs received in Boulder direct from Holland.

T. D. A. COCKERELL.

Apple Tent Caterpillar. In the Seventeenth Report of the State Entomologist of Connecticut (p. 363) reference is made to the practical disappearance of the apple tent-caterpillar (*Malacosoma americana* Fabr.) in many localities of that state in 1917. In describing a reason for this marked decrease after several years of great abundance the following statement is made:—"The reason for its disappearance cannot be explained here, but is probably the effect of parasites or other natural enemies." The writer has also noted a similar phenomenon in several regions of New York but has ascribed it to entirely different causes.

In the vicinity of Syracuse numerous colonies of recently hatched apple tent-caterpillars were found during the last week in April following a week of mild spring weather. This week of spring weather was followed by five weeks of extraordinarily cool weather. Field notes made May 26 record very unexpected observations regarding the brood of the tent-caterpillar. Several trees of the wild cherry which for the preceding three years had been entirely stripped of their first crop of leaves, were observed to show no signs of defoliation. When a more careful examination was made, colony after colony of tent-caterpillars were found entirely exterminated, the small tents being occupied by the dead bodies of the minute recently hatched larvæ. In a few of the nests were found from one to five living caterpillars a half inch or more in length, the dead larvæ which comprised the remainder of the colony being less than a quarter of an inch long. According to a rough estimate made at the time, less than one per cent of the larvæ had survived. It is likely that the ultimate survivers represent a much smaller per cent when it is taken into consideration that this species is so dependent upon their tent for protection from inclement weather conditions, and that the few survivers of a colony would probably be unable to construct an adequate shelter.

The explanation which at the time we believed accounted for the extraordinary mortality among the larvæ was the unusual weather conditions of the spring of 1917. A recent examination of the temperature records for April and May[1] of that year strengthen our belief in the validity of this conclusion. During the five-day period from April 18 to April 22 the maximum temperature each day at Syracuse varied from 66° to 71° and the minimum daily temperature varied from 42° to 51°. It was during this period that the eggs of the tent-caterpillar hatched. During the succeeding period of 26 days (April 23 to May 18) there was only one day (April 29) in which the maximum temperature was above 60° and only four on which it was above 55°. During the entire month of May the mean temperature for the entire state was 48.2° or an average deficiency of 8°. It is likely that the deficiency at Syracuse was even greater than 8° for the period from April 23 to May 18.

During this period the buds of the wild cherry which had begun to open in April ceased developing and the prevailing low temperature and frequent rainfall (there being only 7 days in the 26-day period when there was no precipitation) prevented the caterpillars from feeding so that most of them were killed by starvation before the return of normal conditions. That the death of the larvæ was not due to parasitic or predaceous enemies was evidenced by their size (less than ¼ of an inch) and by the

[1] Climatological Data, New York Section for April and May, 1917, U. S. Dept. Agri., Weather Bureau.

fact that their bodies were unmutilated and their newly started tents were uninjured. It would be interesting to know of other cases where the numbers of certain species of insects have been so directly influenced by weather conditions.

M. W. BLACKMAN,
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The New York State College of Forestry, Syracuse, New York.

Blossom Spraying and Bee Poisoning. Literature on the subject of poisoning bees with lead arsenate in a blossom spray appears strongly in favor of this notion; however in spite of this enlightening influence we find many practical beekeepers and more orchardmen in a doubtful frame of mind regarding the effect on bees of a poison spray at blossom time. In some instances growers vigorously contend that bees are not killed by an arsenic spray applied at this time. Conclusions in these instances are drawn from field observation only, and the habits of the bee make these alone very unsatisfactory.

With a view of clearing up this situation experiments have been undertaken. These are calculated to cover a period of two years, and designed in such a way as to meet the field as well as the laboratory requirements. In planning the outside work special precaution was taken to get actual field conditions which would permit and facilitate the keeping of records on the individual colonies.

The laboratory program consists chiefly of work in analysis of bees and the feeding of individuals known amounts of arsenic to determine a deadly dose. The latter has been finished and it is interesting to note that less than .0000005 gram of arsenic (As_2O_3) proves fatal.

A part of the work is completed and the results obtained seem to indicate that bees may be killed by a poison spray at blossom time. This work will be continued another year after which time a bulletin will be published giving a detailed account of the experiment and results obtained.

JAMES TROOP,
Department of Entomology, Purdue University, Lafayette, Indiana.

An Outbreak of Field Crickets. One of the field crickets, *Gryllus integer*, became so abundant during May and June, 1917, as to cause severe injury in the southern part of the Sacramento Valley (California). This insect is the common field cricket of the locality but has never before caused serious trouble in this vicinity, its usual status being that of a widely distributed species present at all times, but only in small numbers. The winter of 1916–17 was an unusually dry one, the months of February, March and April being characterized by slight rainfalls and with a temperature slightly above normal; these climatic conditions probably contributed to the development of such great numbers. Reports of their attacks on truck crops began coming in during April and by the first of May they were swarming in the grain, migrating continuously back and forth across roads or other intervening spaces in such numbers that the ground seemed alive with them. On one road near the Sacramento River a flock of terns was seen feasting upon them and so thorough was their work that not a cricket was to be seen where they had fed while in front of them there was at least one cricket to every square foot of ground.

The greatest damage which they caused was in newly set vineyards and orchards. New growth on both vines and trees was eaten off to the trunk and even the buds gnawed out to solid wood. Where the attack was prolonged death usually resulted, although in some instances sprouts from the crown kept the plant alive but this meant a loss of the previous years' growth.

The common formula for grasshopper bait (bran and arsenic) was tried but gave little protection. The most successful method of control was flooding the orchard or vineyard for a few hours. This would usually drive them out into grass land or the roadside for a few days at least and give the young planting an opportunity to recover. By the first of June the crickets had disappeared so completely that it was with difficulty a single specimen could be found.

E. RALPH DE ONG.

Thrips Injuring Peaches. Five or six years ago peach growers in the vicinity of Benton Harbor reported the presence of something producing blemishes on fancy peaches. The injury consisted of shallow, gummed scars on the fruit, little more than skin deep—injury that does not interfere with the quality to any extent, but

which places what would otherwise be a fancy peach, in the second class or lower because of its appearance. The cause of this injury was obscure and was only made known after a trip by Mr. G. C. Woodin, at that time an assistant in this department, who managed to get to the orchard at the right time, just after the fruit set and while the little peaches were growing rapidly. On many of these peaches one would find patches of slightly discolored fuzz, which, when stirred with a needle were found to be practically eaten off or shriveled close to the skin of the fruit. In these patches were many miniature thrips which disappeared into the standing fuzz when disturbed. Such patches showed the skin to be abraded somewhat, but the surfaces healed and were covered with gum soon afterward, resulting in blemishes. The work of plum curculio was to be seen on the same fruit from time to time, and curculio eggs were to be seen sometimes in the denuded patches, although the work of the thrips is not characteristic of the curculio.

The damage by the thrips seems to be all done before the pits begin to harden and, therefore, before thinning time, which is fortunate because it makes it possible to eliminate many of the blemished fruits during thinning.

It is interesting to note that the injury seems to be most severe in the highest, driest, and warmest parts of the orchards and during seasons having hot, dry springs.

During June of 1917 Mr. P. B. Wiltberger, an assistant in this department, suc-

ceeded in collecting a quantity of the adult thrips which were submitted to Dr. W. E. Hinds of Auburn, Alabama, who pronounced them to be *Euthrips tritici* (Fitch), whose habit of working in strawberries is well known.

Since finding the blemished fruit in our western fruit belt, the writer has observed similarly blemished fruit in various stores in other parts of the state where peaches were offered for sale.

R. H. PETTIT,
Entomologist of Experiment Station, Michigan Agricultural College,
East Lansing, Michigan.

THIRTY-FIRST ANNUAL MEETING, AMERICAN ASSOCIATION OF ECONOMIC ENTOMOLOGISTS

Baltimore, Md.—December 30–31, 1918

The Thirty-first Annual Meeting of this Association will be held in Baltimore, Md., December 30 and 31, 1918. Owing to war conditions it has been thought best to arrange a program which will give particular prominence to the insect problems that are vital in connection with war activities.

Members are requested to forward titles of the papers which they wish to present, and to submit subjects which are of special importance in connection with winning the war. New discoveries or information which has recently been secured along these lines should be presented for consideration at the meeting.

In order that the program can be completed, so that it can be printed in the December issue of the JOURNAL, it is necessary that all titles of papers be in the hands of the secretary not later than November 9, 1918.

Applications for membership may be secured from the secretary, or from the chairman of the committee on membership. It is especially desired that all applications be filled out, endorsed and placed in the hands of the chairman of that committee well in advance of the date of the meeting.

A. F. BURGESS,
Secretary.

MEMBERSHIP COMMITTEE NOTICE

Precedent provides that active members desiring to nominate associate members for active membership shall file such nominations with the chairman of the membership committee prior to the annual meeting. Nominations must be accompanied by full information concerning the nominee's publications and other qualifications. Where possible, copies of the publications enumerated should accompany the application.

It is also earnestly requested that associate members send a list of their publications, or better the publications themselves, together with a list of papers by other authors with which they have been associated during the investigation, to the chairman of the membership committee, marking them "For membership committee" so that they may be available to the committee in considering promotions from associate to active membership. Copies of publications should be sent to each member of the committee when possible.

JOURNAL OF ECONOMIC ENTOMOLOGY

OFFICIAL ORGAN AMERICAN ASSOCIATION OF ECONOMIC ENTOMOLOGISTS

AUGUST, 1918

The editors will thankfully receive news items and other matter likely to be of interest to subscribers. Papers will be published, so far as possible, in the order of reception. All extended contributions, at least, should be in the hands of the editor the first of the month preceding publication. Contributors are requested to supply electrotypes for the larger illustrations so far as possible. Photoengraving may be obtained by authors at cost. The receipt of all papers will be acknowledged.—Eds.

Separates or reprints, if ordered when the manuscript is forwarded or the proof returned, will be supplied authors at the following rates:

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Free admission, exclusion and extermination are three distinct policies followed in this country in relation to foreign insect pests. The first is characteristic of the early days and is the rule now in some measure. One of the great difficulties with exclusion or rigid quarantine is that it does not exclude. The history of the past twenty-five years might lead one to believe that prohibition (we are not now considering the liquor problem) has resulted in more rather than fewer introductions, though before assenting to any such conclusion allowance must be made for the greatly improved and increased commercial activities during this period and now abridged in considerable measure. The fact is that no system of commercial quarantine absolutely prevents the introduction of insects, though it may greatly delay the establishment of many. Furthermore, a quarantine possible under present conditions might break under its own weight when the present war ceases and there follows a most extensive commerce between this country and at least certain European nations. This factor should be carefully weighed before great changes are made in our quarantine regulations. It is impossible to maintain a Chinese wall. We are an essential part of the world and as such must share the dangers as well as blessings of our position. The problem is to secure the maximum protection practicable with a minimum disturbance of international and interstate relations.

Extermination of insects is a device to offset ineffective exclusion and is applicable only where the infested area is limited or special conditions favor such an attempt. It is a comparatively recent policy and available experience by no means sharply defines its possibilities.

The State of Massachusetts attempted to exterminate the gipsy moth and failed and yet this insect has been eradicated in other sections of the county where there was considerable infested territory of a somewhat difficult nature. We are inclined to believe that the effort in Massachusetts was possible though not practicable. It might have been entirely feasible for the general government. Attempts are now being made to exterminate or greatly restrict the spread of free flying insects. These efforts have not progressed to the point where success is a foregone conclusion. It is characteristic of the times that propositions of this nature are being received with an optimism unknown in the earlier days. There are a number of cases where extermination, even were most drastic measures necessary, would have been cheaper than the cost of subsequent control. Should extermination be successful, the possibility of reëstablishment in a similar manner must not be overlooked. It is an excellent time to forecast probabilities and determine the most promising lines of effort.

Obituary

STUART C. VINAL

MR. STUART C. VINAL, assistant entomologist of the Massachusetts Experiment Station, died at Arlington, Mass., September 26, as the result of typhoid pneumonia following influenza. Mr. Vinal graduated at the Massachusetts Agricultural College in 1915 and continued his entomological work there for an advanced degree, receiving his M. S. in 1917. In September of that year he was appointed assistant entomologist at the Massachusetts Experiment Station, after which his time was mainly devoted to investigations on market garden insects. He was a young man of unusual ability and the work he accomplished was excellent in its quality. His three published papers are "Notes on the Life-History of *Marmara elotella* Busck," Journ. Econ. Ent., 10: 388; "The Greenhouse Red Spider Attacking Cucumbers and Methods for its Control," Bulletin No. 179, Mass. Exp. Sta., and "The European Corn Borer, *Pyrausta nubilalis* Hübner," Bulletin No. 178, Mass. Exp. Sta. Another paper, "A Morphological Study on the Respiratory System of the Carolina Locust" is awaiting publication. All of his time during the past year has been devoted to an investigation of the life-history of the European corn borer, and he had collected material on this for another bulletin to be published this fall. The material thus obtained will probably be combined with that collected by workers in the Bureau of Entomology, with whom he was coöperating at the time of his death.

HAROLD O. MARSH

HAROLD OSCAR MARSH died September 10, 1918, at Chester, N. J., the place of his birth.

Mr. Marsh was born November 6, 1885. He was educated in the public schools at Chester and took a special course in entomology at the Kansas Agricultural College, Manhattan, Kansas, in 1914. Prior to his employment in the Federal Bureau of Entomology, he was engaged in special work under the direction of the State Entomologist of New Jersey, and later of the State Zoölogist of Pennsylvania at Harrisburg. He was first appointed in the Bureau of Entomology July 1, 1908, having served ten years as an entomological assistant in truck-crop insect investigations. In the Civil Service examination which he took in economic entomology he obtained the highest rating among quite a number of applicants. His first employment was in Washington, D. C.; later he was in charge of sugar-beet insect investigations at Rocky Ford, Colorado, and at times was also engaged in similar work on truck-crop pests at Brownsville, Texas, in California, and for a short time in Hawaii. His principal work was accomplished while in Colorado. He had recently retired from active work in the Bureau, in order to take charge of his farm in New Jersey, where he was employed as a collaborator, but he had planned to resume active work in the early spring.

Mr. Marsh was an enthusiast, an observer of unusual excellence and was particularly adept at life-history work, excelling especially in obtaining the various stages of an insect and determining the life cycle and generations. He was unusually skillful in mounting and preparing all specimens which came under his notice, and this attracted much favorable comment. He was also a careful experimenter and kept accurate records of all his work.

Personally, Mr. Marsh was well liked in the community where he worked and by others who knew him; he was always prompt, painstaking and earnest, working early and late whenever the occasion demanded. In spite of a heavy handicap, a frail physique and eye troubles, he succeeded in accomplishing a great deal of work. The following is a list of his principal publications:

Biologic and Economic Notes on the Yellow-Bear Caterpillar. Bul. 82, pt. V, Bur. Ent., U. S. Dept. Agr., Aug. 31, 1910.

Notes on a Colorado Ant (*Formica cinereorufibarbis* Forel). Bul. 64, pt. IX, Bur. Ent., U. S. Dept. Agr., Oct. 17, 1910.

Biologic Notes on Species of Diabrotica in Southern Texas. Bul. 82, pt. VI, Bur. Ent., U. S. Dept. Agr., Dec. 8, 1910.

Notes on the Oviposition of the Tarnished Plant-Bug (joint with F. H. Chittenden) Jour. Econ. Ent., Dec., 1910, pp. 477-479.

The Hawaiian Beet Webworm. Bul. 109, pt. III, Bur. Ent., U. S. Dept. Agr., Nov. 6, 1911.

Report of the Assistant Entomologist. Bienn. Rpt. Bd. Agr. & For., Hawaii, pp. 152–159, 1910 (1911).

Some Experiments on the Chrysanthemum Plant-Louse (*Macrosiphum solanifolii Osborni* Gillette). Bienn. Rpt. Bd. Agr. & For., Hawaii, pp. 160–172, 1910 (1911).

The Imported Cabbage Worm (joint with F. H. Chittenden). Bul. 109, pt. III, Bur. Ent., U. S. Dept. Agr., Apr. 5, 1912.

The Sugar-beet Webworm. Bul. 109, pt. VI, Bur. Ent., U. S. Dept. Agr., Sept. 16, 1912.

The Horse-radish Webworm. Bul. 109, pt. VII, Bur. Ent., U. S. Dept. Agr., Jan. 30, 1913.

The Striped Beet Caterpillar. Bul. 127, pt. II, Bur. Ent., U. S. Dept. Agr., May 19, 1913.

Life-history of the Diamond-back Moth. Jour Agr. Research, U. S. Dept. Agr., July 2, 1917.

Notes on the Life Cycle of the Sugar-beet Webworm. Jour. Econ. Ent., Dec., 1917, pp. 543–544.

In addition to the list of publications above furnished, Mr. Marsh had contributed a considerable amount of work on other topics, including reports on the onion thrips in Colorado, on the larger beet leaf-beetle, on the false chinch-bug, on the bean leaf-beetle, and on the western cabbage flea-beetle.

F. H. C.

Current Notes

October, 1918

Mr. J. L. Horsfall has been appointed assistant in entomology at the Iowa College and Station.

Mr. R. H. Smith has been appointed entomologist of the Idaho Station vice A. C. Burrill, resigned.

Dr. Charles T. Brues has been promoted to be assistant professor of economic entomology in Harvard University.

The field laboratory of the Bureau of Entomology formerly located at Wellington, Kansas, has been removed to Wichita.

Surgeon-General William C. Gorgas accompanied Secretary Baker on his visit to the French battle front in September.

Mr. George Gilbertson, instructor in entomology at the South Dakota College and Station, is now in the military service.

Dr. L. O. Howard, chief of the Bureau of Entomology, during the summer, visited all of the field stations throughout the western states.

Professor E. R. King, assistant professor of entomology at Cornell University, has been commissioned second lieutenant in the Aviation Corps.

Mr. Dwight M. DeLong, of the office of the Pennsylvania Economic Zoölogist, has entered military service and is now at Camp Sherman, Ohio.

Mr. W. A. Thomas, assistant entomologist of the South Carolina Station and assistant professor of entomology in the College, has resigned.

Mr. W. D. Whitcomb, of the division of deciduous fruit insect investigations, Bureau of Entomology, has left the Bureau for Military Service.

Mr. Joseph L. King, of the office of the Pennsylvania Economic Zoölogist, has entered the Naval Reserves and is at Wissahickon Barracks, Cape May, N. J.

Mr. K. C. Sullivan has been appointed instructor in entomology at Missouri University and Station, and deputy inspector of nurseries vice A. H. Hollinger.

According to *Science* Mr. E. P. Van Duzee, curator of entomology, California Academy of Sciences, spent this summer in northern California collecting insects.

Mr. Herbert Spencer, formerly instructor in the department of zoölogy and entomology, North Carolina State College, had resigned to enter the Military Service.

Prof. Louis A. Stearns, department of biology, Alma College, Alma, Mich., has accepted a position as assistant entomologist of the Virginia State Crop Pest Commission.

Dr. W. L. Chandler, instructor in parasitology, Cornell University, has been appointed research associate in entomology at the Michigan Station vice Dr. G. D. Shafer.

Prof. P. W. Mason, assistant professor of entomology, Purdue University, has resigned to accept a position in the Bureau of Entomology, deciduous fruit insect investigations.

Mr. V. I. Safro is specializing as a fighting observer in the Aviation School at Mount Clemens, Mich., after having passed successfully in courses at Urbana, Ill., and at Dallas, Tex.

Mr. G. W. Underhill, formerly instructor in the department of zoölogy and entomology, North Carolina State College, has resigned to accept a position with the state entomologist of Virginia.

Dr. Gustavo Leonardi of the Royal Scuola di Agricoltura, Portici, Italy, the well-known Coccidologist and a foreign member of this association died in Ventimiglia, August 25, aged 49 years.

Mr. Thomas L. Guyton, formerly assistant entomologist of the Ohio Agricultural Experiment Station, is now a member of the staff of the Bureau of Zoölogy of the Pennsylvania State Department of Agriculture, Harrisburg, Pa.

According to the *Experiment Station Record*, the department of entomology of the New Jersey Station is making detailed maps of the area infested by the Japanese beetle, *Popilia japonica*, with a view to attempting its eradication.

Mr. C. H. Kennedy, a graduate of the Leland Stanford University and at present assistant in the department of entomology, Cornell University, has been appointed instructor in zoölogy and entomology at the North Carolina State College.

Dr. Burton N. Gates has resigned from the Massachusetts Agricultural College, Amherst, Mass., to accept a position as professor of apiculture in the Ontario Agricultural College, Guelph, Ont. Dr. Gates was married June 15 to Miss Carpenter of Amherst.

Prof. G. H. Lamson, Jr., of the Connecticut Agricultural College, Storrs, Conn., has been appointed a collaborator of the Bureau of Entomology, and will aid in devising methods for the control of insects in the trenches and around the military camps.

The following transfers have been made in the Bureau of Entomology: Dr. W. V. King has been placed in charge of the mosquito investigations at Mound, La.; A. P. Swallow to College Station, Tex.; H. O. Marsh, active service, Colo., to collaborator, Chester, N. J.

Mr. F. H. Lathrop, research assistant in the Department of Entomology, Oregon Agricultural College, has received a commission as second lieutenant in the Sanitary Corps of the army and was granted a leave of absence from the college for the duration of the war.

Mr. A. B. Black, a graduate of the college and temporary field specialist in the Bureau of Entomology, has been appointed assistant entomologist at the Oregon Agricultural College. His major problem will he a study of the control of the western peach and prune root borer.

Dr. Samuel Wendell Williston, professor of paleontology at the University of Chicago, died August 30, aged 66 years. Dr. Williston formerly paid much attention to a study of the Diptera, and published many papers including "Synopsis of the North American Syrphidæ" (Bulletin No. 31, U. S. National Museum) and "Manual of North American Diptera" which reached its third edition in 1908.

Mr. Lloyd R. Watson of the New York School of Agriculture at Alfred, N. Y., has been appointed to take charge of the new department of beekeeping at the Connecticut Agricultural College at Storrs, Conn. Mr. Watson will have charge of the College apiary, will give courses in beekeeping to the resident students and during the first year will probably devote the major portion of his time to extension work.

According to *Science* a bill (Senate bill No. 3344) has been introduced by Senator Weeks of Massachusetts to prohibit the entry into the United States except by the secretary of agriculture, of all nursery stock. Field, vegetable and flower seeds, bedding plants, and other herbaceous plants, bulbs and roots are exempt from its provisions, and any stock brought in by the secretary of agriculture must be held in quarantine for a sufficient period to establish its freedom from insect pests and plant diseases.

Resignations from the Bureau of Entomology are announced as follows: H. S. Saidel, C. H. Alden, D. A. Davis and A. D. Tilton to enter the army; R. S. Clute, Fla.; Ward H. Foster; E. F. Atwater; A. LeRoy Strand; R. B. Wilson; Perry W. Fattig, Fla.; Dr. O. H. Basseches, to become inspector in the Bureau of Animal Industry; H. E. Loomis and A. H. Jarrell to enter the navy; Marshal Hertig, Minn., A. H. Sherwood, S. D., H. L. Seamans, Mont., C. K. Fisher, Colo., J. S. Stanford, to enter the army.

The following appointments to the Bureau of Entomology have been announced: temporarily, tobacco insects, S. F. Grubbs, J. W. Hill, Scott C. Lyon, D. M. Rogers: cotton insects, Turner Davis, C. M. Brickwell; P. W. Mason, scientific assistant,

F. L. Wellman, C. I. Bliss, field assistants. Deciduous Fruit Insect Investigations: Dr. Norman Perrine, inspector, Federal Horticultural Board; Miss Ada F. Kneale, scientific assistant, Forest Insects; Geo. A. Hummer, extension apiculturist, Miss.; J. H. Morrison, Colo.; W. A. Thomas, N. C.; Geo. H. Vansell, S. C.; F. W. Humphrey, Tex.; Robert Fouts, Penn.; Mrs. Sibyl Swegman, artist; E. C. Davis, apiculture extension work, La.; Miss Edith M. Brace, scientific assistant, Washington, D. C.; temporary field assistants, D. C. Barney, J. J. Dickson, A. O. Hammett, A. G. Monette, J. W. Patterson, E. B. Smith, G. L. Smith, R. J. Smith, C. G. Wallace, A. L. Williamson, H. C. Young, Tallulah, La.; C. M. Barrett, C. P. Daley, L. N. Judah, J. T. Lewis, Jr., N. L. MacQueen, G. B. Pearson, A. L. Spencer, T. P. Weakley, Clarksville, Tenn.; S. H. Livingston, Mound, La.; Miss Mabel S. Stehle, scientific assistant, Washington, D. C.; M. V. Reed, collaborator, Atlanta, Ga.; Herbert J. Pack, Herbert F. Gates, Eastern, Mass.; Stewart Lockwood, N. D.

A conference regarding the European Corn Borer *Pyrausta nubilalis* Hbn. was held at the State House, Boston, Mass., September 6, 1918. All the New England States, New York and the Federal Bureau of Entomology were represented. This promises to be a very destructive pest and now infests an area about 15 X 25 miles in extent near Boston, but reaching mostly westward and northward of the city. There are two and possibly three generations each year, and the species is only slightly parasitized. Its attacks are not confined to corn, but at least sixteen different plants are eaten, including barnyard grass, dock, pigweed, bean, tomato, etc. Vermont and Connecticut have placed embargoes against corn on the ear and cornstalks from Massachusetts, and other states will probably follow suit and a Federal quarantine will probably be established soon. Those present were Dr. L. O. Howard, Washington, D. C.; Dr. E. P. Felt, Albany, N. Y.; Dr. H. T. Fernald, Amherst, Mass.; Prof. W. C. O'Kane, Durham, N. H.; Dr. W. E. Britton, New Haven, Conn.; Harold L. Bailey, Bradford, Vt.; Frank H. Dudley, Augusta, Me.; C. H. Batchelder, Orono, Me.; J. J. Pillsbury, Providence, R. I.; Prof. W. D. Hurd, Amherst, Mass.; S. C. Vinal, Amherst, Mass.; S. H. Gates, Arlington, Mass.; R. H. Allen, state nursery inspector, Boston, Mass.; Messrs. C. O. Bailey, Willis Munro, J. C. Gilbert, John W. Law, Alton E. Briggs, Boston, Mass.; and Messrs W. R. Walton, A. F. Burgess, L. H. Worthley, D. J. Caffrey, R. I. Smith and R. E. Snodgrass of the Bureau of Entomology.

According to *Science* the British Board of Agriculture and Fisheries has appointed a committee to study the life habits of the honey bee with the object of improving the conditions under which beekeeping is carried on in England and Wales, and to investigate the epidemic diseases of the bee, more especially the disease or group of diseases which pass under the name of "Isle of Wight" disease. The committee consists of: The Master of Christ's College, Cambridge (Dr. A. E. Shipley, F. R. S.) Professor Punnett, F. R. S. (professor of genetics, Cambridge); Dr. G. S. Graham Smith, M. D.; Professor G. C. Bourne, F. R. S., D. Sc. (professor of zoology and comparative anatomy, Oxford); Prof. W. Somerville (professor of rural economy, Oxford); Mr. T. W. Cowan (chairman of the British Bee-keepers' Association); Mr. G. W. Bullamore; Mr. J. C. Bee Mason; and Mr. A. G. L. Rogers (head of the Horticulture Branch, Board of Agriculture and Fisheries). Mr. R. H. Adie will act as secretary. It is proposed to undertake the study of healthy bees at Cambridge and the investigations on Isle of Wight disease at Oxford. The committee would be glad to receive specimens of bees suspected of suffering from "Isle of Wight" disease for examination and experiment.

Mailed October 26, 1918.